

FACULTY OF
MEDICAL
LABORATORY
SCIENCES





VISION AND MISSION

The vision of the Faculty MLS is to be the best institution in the country providing this type of professional education, as manifested by excellent learning environment and facilities, well-structured curriculum and reputable positive ethical codes of learning and practice. The mission is to graduate up-to-date research-oriented medical technologists in laboratory sciences, with a strong commitment to solve health problems, in a rich science environment, aligning with a comprehensive and devout health team.

ENTRANCE REQUIREMENTS

A student interested in joining the Faculty of Medical Laboratory Sciences, 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 religious 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 Education, or apply directly in Admission Office in the National University, and pass the health examination, aptitude tests and interview at the Faculty of Medical Laboratory Sciences.
4. Pay the published fees: 18,000 SDG or US \$ 4,500 [international students]

CAREER ADVICE

Students qualified with this Bachelor degree pass through a track decreed by the Health Professions Council, and are accredited as technicians. They may pursue postgrad studies to obtain master's degree PMLS honours or PhD in the field of medial labs to qualify for a university teaching job, in programmed of health professions. 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.

FACULTY OBJECTIVES

The objectives of The Faculty of-MLS National University are to:

1. Emphasize the 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 (see Mission and Message at website www.nu.edu.sd)
2. Graduate a health professional with a bachelors degree in Medical Laboratory Science (B.MLS) Honours, competent in laboratory sciences and skills, with strong community orientation, social and ethical commitments, aware of and utilizing all recent and emerging developments in evidence-based laboratory science education and practice.
3. Contribute to community development through health services provided in its own health institutions, and other institutions cooperating with them, through: (a) partnership in designing health programmed and plans, and implement whatever is feasible in utilizing the specialists, (b) contribute in continuous education, through self-directed learning of technologists, and (c) provision of essential equipments and supplies to improve the quality of health services planned by the ministries of health and other related sectors.
4. Strengthen medical and health research in MLS, making use of the University's infrastructural privileges and national and international relations.

CURRICULUM OBJECTIVES [Characteristics of the MLS graduate]

A graduate of the National University, Faculty of MLS Programme should be able to:

1. Adopt the strategies of the National University - Sudan and abide by its objectives, rules and regulations stated in the Order of Establishment (NC-Docs-8/1, dated January 2005, updated 2008).
2. Observe, in his/her practice, the health professional ethics which agree with the Nation's values, beliefs and norms (as stated by Sudan Allied Health Professions' Council), and maintain good and honest relations with her/his, their families, his/her colleagues across all sectors involved in health.
3. Appreciate the value of diversity and multi-ethnicity in solving laboratory work with emphatic, humane and fair practice.
4. Integrate basic, community, laboratory and clinical sciences in solving community, family and individual health problems relevant to laboratory sciences.
5. Use scientific knowledge in investigating health problems, according to known methods and procedures, and show understanding of the scientific structural (anatomical), functional (physiological, biochemical), morbid (microbiological, pathological), and therapeutic (pharmacological) background related to the problem.
6. Take specimens timely and professionally, and arrange for comfort of the patient and relatives, especially in tests taking longer time.

7. Follow correctly the practical steps of completion and explanation of testing biochemical, hematological, immunological, microbiological and histochemical components in biological specimens
8. Differentiate colour, smell, clarity and viscosity of biological and chemical specimens relevant to human health.
9. Carry out the correct histological and histochemical techniques and use correctly the facilities of light microscope.
10. Show understanding of the techniques for ultrastructural or electron microscopy, outline the components of transmission and scanning machines and recognize images from both.
11. Run laboratory test using common equipments and take safety precautions of fellow workers, patients, public, equipments and building- in dealing with chemicals and specimens.
12. Manage the investigative plan in emergencies and life-saving situations, and decide and act properly on cases needing referrals to specialized centres and personnel.
13. Accept to work in all settings according to needs, and act to improve health service delivery system both quantitatively and qualitatively.
14. Encourage community participation and help in recruiting various sectors in defining health related problems, planning and providing suitable solutions, recognizing the community beliefs, ethics and traditional practices.
15. Adhere to the "health team" approach, acting as an efficient member, accepting labor and responsibilities given to its members, and promoting both effectiveness and homogeneity among members.
16. Continue to consider elements of efficiency, costing and economic implications in her/his approach to (and choice of) laboratory procedures.
17. Acquire the skills of teaching, learning and communicating efficiently to carry out his/her duties in health education and in winning the confidence of patients and their families.
18. Show respect to patients, supervisors and colleagues using productive communication with each of them, and observing confidentiality at all levels of communication and care.
19. Acquire the skills of independent learning and contribute to availing opportunities for planning and implementing continuous educational activities to upgrade her/his own abilities and those of his/her colleagues in the health team, benefiting from the rising tide of information technology.
20. Carry out health and health-related research, alone or the other members of the a team in health or with other relevant sectors, using known (or approved) scientific methods.
21. Use computers in word processing (both Arabic and English), presentations, spread sheets, statistical packages and graphics to achieve success in other objectives of his/her career.
22. Acquire postgraduate qualifications in the discipline of her/his choice, recognizing the needs of the society for certain specialties, particularly parasitology, immunology, molecular biology, drug development, production and maintenance of medical laboratory equipments, media, reagents and other supplies.

EDUCATIONAL STRATEGIES AND METHODS

As stated in the Academic Regulations (NC-Docs 7/4, dated January 2005) and in the general Prospectus of other Programmes, the learning strategies emphasize the following: (1) early acquisition of basic skills, (2) student-centred learning, and maximum student responsibility in the learning process, (3) problem-based and problem oriented instruction, (4) community-oriented and community-based activities, (5) integration of basic science, community and clinical practice, in a multidisciplinary approach, (6) self- and peer- education and evaluation, wherever relevant, (7) team-work attitude, (8) a range of elective modules, (9) continuous evaluation, (10) preparation for continuous professional development.

The Faculty adopts the following methods in the daily programme 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 programme would allow- at least one per module), (8) electives -not more than 10% of the curriculum timetable, and (9) graduation project.

TIMETABLE

Semester 1 [23 CHs- 18 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Islamic studies-1	ISLAM-111	Longit.	2	-	-	2
2	Arabic language-1	ARAB-112	Longit.	2	-	-	2
3	English language-1	ENG-113	Longit.	2	-	-	2
4	Sudanese studies-1	SUDN-110	Longit.	2	-	-	2
5	Biostatistics	ME-STAT-117	Longit.	2	-	-	2
6	Orientation week	-	-	-	-	-	-
7	Computer science-1	ME-COMP-116	2	1	-	1	2
8	Physics for med. Equipment and investigations	ME-PHYS-115	3	2	-	1	2
9	Introduction to medicine and medical education	ME-EDU-114	3	1	-	1	2
10	Basic biochemistry	ME-BIOC-118	3	1	-	1	3
11	Genetics and molecular biology	ME-GET-119	2	2	-	-	2
12	Computer science-2	ME-COMP-124	3	1	-	1	2
			16	18		5	23

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

Courses or examinations for late comers and failures.

Semester 2 [22 CHs- 18 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Islamic studies-2	ISLAM-121	Long.	2	-	-	2
2	Arabic language-2	ARAB-122	Long.	2	-	-	2
3	English language-2	ENG-123	Long.	2	-	-	2
4	Sudanese studies-2	SUDN-120	Long.	2	-	-	2
5	Medical terminology	ME-TERM-125	Long.	1	-	1	2
6	Introduction to medical ethics	ME-ETHIC-226	Long.	2	-	1	3
7	Human body structure & function	PA-NAT-126	5	2	1	1	4
8	Medical entomology & parasitology	ME-PAR-125	3	2	-	-	2
9	Organic chemistry	ORGCH-124	3	2	-	1	3
10	Analytical chemistry	ANCH-126	5				
			16	17	1	4	22

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

SUMMAR 1 AND ELECTIVES.

1. Medical terminology- Laboratory and data collection (MLS-SUM-131) 2 CHs
2. 1000 –word report on “Internet Sources of Medical Laboratory Sciences” 1CH (E-131) 2CHs
3. Health Care System Elective (SUM-ELEC-132):2 CHs
4. Repeat courses or examinations for late comers and failures.

FIRST YEAR PROGRAMME EVALUATION

Semester 3 [19 CHs- 19 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Professional skills-1	MLS - SKILL-211	Long.	-	-	2	2
2	Physiology	MLS - PHYL-212	3	3	-	-	3
3	Introduction to MLS	MLS - INTR-217	2	2	-	-	2
4	Basic histology & histological techniques	MLS - HIST-218	4	2	-	1	3
5	Sterilization, disinfection & lab safety	MLS - STR-213	3	2	-	1	3
6	Clinical biochemistry	MLS - CCH-216	3	2	-	1	3
7	Basic haematology	MLS - HEM-214	3	2	-	1	3
			18	13	-	6	19

Examination of longitudinal courses (+re-sits)

1 week

Semester 4 [22 CHs- 21 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Professional skills-2- Basic lab skills	MLS-SKIL-221	Longit.	-	-	2	2
2	Systemic pathology	MLS-PATH-222	5	4	-	1	5
3	Basic immunology	MLS-IMU-223	4	3	-	1	4
4	Serology & clinical immunology	MLS-SER-224	4	3	-	1	4
5	Advanced parasitology	MLS-PAR-225	5	3	-	2	5
6	Introduction to research	ME-REC-227	2	1.5	-	0.5	2
			20	14.5	-	7.5	22

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

SUMMAR 2 AND ELEVTIVE MODULES

1. Research methodology and scientific writing- Rural Resear4ch Residency (MLS-REC 231) 2 CHs
2. Repeat courses or examinations for late comers and failures.

SECOND YEAR PROGRAMME EVALUATION**Semester 5 [22 CHs- 21 weeks]**

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Professional skills-3- Basic lab skills	MLS-SKIL-311	Longit.	-	-	2	4
2	Clinical chemistry	MLS-CCH-312	6	3	-	3	6
3	Clinical microbiology	MLS-MICR-313	4	2	-	2	4
4	Advanced hematology	MLS-HEM-314	4	2	-	2	4
5	Cytological & histopathological techniques	MLS-HIST-315	6	3		3	6
			20	10	-	12	22

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

Repeat courses or examinations for late comers and failures.

Semester 6 [19 CHs- 19 weeks]:

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Professional skills-4- Basic lab skills	MLS-SKIL-321	Longit.	-	-	2	2
2	Molecular biology & techniques	MLS-MBT-322	5	3	-	1	4
3	Community medicine	MLS-COM-323	4	3	-	1	4
4	Medical ethics	ME-ETHIC-324	2	2	-	-	2
5	In-service training	MLS-TRN-325	4	1	--	3	4
6	Laboratory management & quality assurance	MLS-QUAL-326	3	2	-	1	3
			18	11	-	8	19

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

SUMMAR 3 AND ELECTIVES

1. Rural Hospital Laboratory Residency (MLS-SUM-331)2 CHs Block 2 weeks
2. Elective (E332): A 1000 work essay on malpractice in MLS 1CH
3. Repeat courses or examinations for late comers and failures.

THIRD YEAR PROGRAMME EVALUATION

Semesters 7 & 8 [20 CHs- 20 weeks]

Examinations (2weeks)

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

Microbiology/ Clinical Immunology	Clinical Chemistry	Parasitology/ Medical Entomology	Hematology	Cytology histopathology
Immunological techniques MLS-MICR-411, 6 CHs (6 weeks)	Primary care clinical chemistry – MLS-CCHM-411, 6 CHs (6 weeks)	Medical entomology- MLS-PAR-411, 4 CHs (2 weeks)	Hemostasis and bleeding disorders investigations-MLS-HEM-411, 4 CHs (4 weeks)	Cytology and cytological techniques – MLS-HIST-411, 4 CHs (4 weeks)
Bacteriological techniques, MLS-MICR-412, 8 CHs (8 weeks)	Advanced clinical chemistry- MLS-CCHM-412, 6 CHs (6 weeks)	Parasitology and immunoparasitology- MLS-PAR-412, 8 CHs (8weeks)	Anaemias and hemoglobin disorders investigations- MLS-HEM-412, 8 CHs (8 weeks)	Histopathological techniques- MLS-HIST-412, 8 CHs (8 weeks)
Virology techniques MLS-MICR- 413, 3 CHs (4 weeks)	Clinical chemistry and public health- MLS-CCHM-413, 6 CHs (6 weeks)	Tropical diseases / public health – MLS-PAR-413, 8 CHs (8weeks)	Leukemias and lymphomas investigations- MLS-HEM-413, 6 CHs (6 weeks)	Cytogenetics/ molecular techniques- MLS-HIST-413, 6 CHs – (6 weeks)
Evidence-based practice in laboratory technology MLS-MICR-414 2 CHs (2 weeks)	Evidence-based practice in laboratory technology MLS-CCHM-414 2 CHs (2 weeks)	Evidence-based practice in laboratory technology MLS-PAR-414, 2 CHs (2 weeks)	Evidence-based practice in laboratory technology MLS-HEM-414, 2 CHs (2 weeks)	Evidence-based practice in laboratory technology MLS-HIST-414, 2 CHs (2 weeks)
20	20	20	20	22
Mycology- MLS-MICR-421, 6 CHs (6 weeks)	Basic chemistry diagnosis- MLS-CCHM-421, 6 CHs (6 weeks)	Basic Parasitological diagnosis - MLS-PAR-421, 6 CHS (6 weeks)	Basic haematological diagnosis – MLS-HEM-421, 6 CHs (6 weeks)	Basic histopathological diagnosis- MLS-HIST-421, 8 CHs (8 weeks)
Infection control –MLS-MICR-422, 6 CHs (6 weeks)	Clinical chemistry equipments- MLS-CCHM-422, 6 CHs (6 weeks)	Field training in parasitology techniques/ inection control - MLS-PAR-422, 6 CHs (6 weeks)	Field training in clinical hematology/ Blood banking- MLS-HEM-422, 6 CHs (6 weeks)	Electron microscopical techniques-MLS-HIST-422, 2 CHs (2 week)
Laboratory management economics-MLS-MICR-423, 2 CHs (2 weeks)	Laboratory management and economics- MLS-CCHM-423, 2 CHs (2 weeks)	Laboratory management and economics- MLS-PAR-423, 2 CHs (2 weeks)	Laboratory management and economics- MLS-HEM-423, 2 CHs (2 weeks)	Laboratory management and economics –MLS-HIST-423, 2CHs (2 weeks)
Health information system- MLS-HINFO-424, 2 CHs (2 weeks)	Health information system- MLS-CCHM-424, 2 CHs (2 weeks)	Health information system- MLS-PAR-424, 2 CHs (2 weeks)	Health information system- MLS-HEM-424, 2 CHs (2 weeks)	Health information system- MLS-HEM-424, 2 CHs (2 weeks)
Graduation project – MLS-RES-425, 6 CHs	Graduation project – MLS-RES-425, 6 CHs	Graduation project – MLS-RES-425, 6 CHs	Graduation project – MLS-RES-425, 6 CHs	Graduation project – MLS-RES-425, 6 CHs

22
GRADUATION

22

22

22

20

OUTLINE OF MODULES

NOTE: In each module the outline includes the basic concepts. Detailed behavioural objectives and hourly timetables will be designed later by specific coordinators.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ISLAMIC STUDIES	ISLAM-111+121	1/Longitudinal	2

Phase 2. Their contents are: (1) the recitation of two Suras of the Holy Quran, which introduces a lot of behavioural and ethical issues for mankind as well as for Muslims, (2) the basic sources of religious thought and religious groups, (3) the principles of deriving a religious rule relevant to the medical profession, and (4) review the Fatwa's likely to come as a request from the community to the health team member working in that community, and all problems that are may arise from emerging issues that require ethical discussion, that leads to better understanding between individuals in groups, to help living in a peaceful and constructively save environment and society.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ARABIC LANGUAGE	ARBIC - 122+ 122	1/Longitudinal	0

This is a National Requirement compulsory to all Arab Speaking Students, which includes two courses: 112 in Phase 1, and 122 in Phase 2. It includes: (1) the basics of Arabic language grammar that would allow students to read and write correctly, (2) pronunciation and punctuation of an Arabic text, (3) summarizing and abridging a lengthy Arabic text, (4) abstracts of Arabic poetry, and (5) principles of translation of scientific text between Arabic and English languages.

Most of the content is detailed in the College Notes (NC- 112/05, and (122/06) , the rest is obtained by self-directed learning and

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ENGLISH LANGUAGE	ENG-113+114	1/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 terms, 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.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
INTRODUCTION TO MEDICINE AND MEDICAL EDUCATION	MEDU-114	1/Block 3 weeks	2

This is a three-week (2 CHs) block, that includes: (1) a simple medical problem that emphasize the meaning and message of health, (2) health care delivery system in the country, (3) the role of the physician in health care,

(4) role of other professional and administrative staff, (5) priority health problems, (6) concepts and principles of learning, (7) adult education and learning, (8) student centred and problem-based learning, (9) instructional techniques (lecture, small group etc), (10) student assessment methods, (11) holistic approach to patient's problems, (12) interdisciplinarity and partnership concepts, (13) curriculum development, (14) programme evaluation, (15) leadership and (16) 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 areas: health system, group dynamics and instructional methods.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
PHYSICS FOR MEDICAL EQUIPMENTS AND INVESTIGATIONS	PHYS-115	1/Block 3 weeks	2

The basic principles of general physics are important for (1) understanding certain mechanisms that take part in the human body, and the (2) 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, sound, and radiation.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
COMPUTER SCIENCE	COMP-116-and 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 colleges 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.

Reading material: College Notes Internet Sources of Medical Sciences

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

This is a two-week block-module on basic statistics as applied to health, to include: (1) introduction to statistics, (2) probabilities, (3) data summary, (4) presentation; (5) measurement of central tendency; (6) interpretation of variation (dispersion), (7) population means, (8) normal distribution, (9) frequency distribution, (10) sampling techniques, (11) calculation and interpretation of the concept of confidence interval, (12) the concept of p-value and its interpretation, (13) the normal and skewed frequency distribution of biomedical data, and (14) apply the appropriate test of significance for a given data set and a given research methodology (using t test as an example).

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
INTRODUCTION TO MEDICAL LABORATORY TECHNOLOGY	MLS-118	1/Block 4 weeks	4

This is a four-week-block-module which introduces newly enrolled students to the administrative, professional and technical responsibilities of the medical laboratory technologists. The major technical areas are the basic and laboratory sciences: (1) parasitology (2) microbiology, (3) immunology and serology, (4) clinical chemistry, (5) hematology and immunohistochemistry and (6) histopathology. The professional competences include: (1) the organization of health system, hospital and laboratory, (2) communication, (3) legal and ethical issues and (4) pursuit of certification, licensure and continuous professional development. The administrative duties include (1) managing a laboratory assuring quality, (2) purchase of equipments and supplies, (3) facilitating the flow of patients and services and (4) observing the economic burden and impact of infrastructure, consumables and services on the patient, family, community, health provider and institutional stake holders.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ORGANIC CHEMISTRY	ORCH-124	2/Block 2 weeks	2

This is a two-week block module that introduces a systematic study of structure and function of organic material, including: (1) chemical structure, physical and chemical properties, (2) preparation and reactions of heterocyclic aromatic compounds, alkanes, alkenes and alkynes, (3) the study of the functional groups such as alcohol, ether, epoxide amine, carboxylic acid, aldehyde and ketone, (4) stereochemistry of organic molecules with emphasis on geometrical and optical isomerism and conformation, (5) reaction mechanisms and stereochemistry of nucleophilic substitution, (6) elimination and addition reactions, (7) the theory and practice of UV, IR, NMR and mass spectroscopy.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
MEDICAL ENTOMOLOGY AND PARASITOLOGY	ME-PAR-125	2/Block 3 weeks	3

Insects have tremendous potential for transmitting pathogens that cause disease in human and other animals. The disease-causing organisms include protozoa, viruses, bacteria, and worms. The deadliest disease worldwide is malaria which is vectored by mosquitoes, which can also transmit viruses (including those causing encephalitis) and filarial nematodes. Other vectors include flies and ticks. This is a three-week (3 CHs) block, concerned with vectors' surveillance and control, considering the operational control personnel as one of the health team. There is special emphasis on: (1) insects and closely related arthropods that impact human health, (2) the life cycles

of the vectors and parasites, their geographical distribution, ecology, and (3) the epidemiology, presentation and broad management and control of the diseases caused by them. These include parasites of the intestinal tract, blood-borne parasites and those found in other body sites.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ANALYTICAL CHEMISTRY	ANCH-126	2/Block -4 weeks	4

This is a four-week-block module that aims at studying principles of analytical chemistry and their application to liquid biological specimens. The details include: (1) study of the various types of analytical titrations, especially titrating acids, alkalis, (2) hydrogen ion concentration and calculating pH of solutions, (3) buffer solutions and the method of their preparation and their mechanism of actions, (4) calculating the pH for buffer solutions, (5) definition and classification of the means of chemical analysis, (6) atomic and molecular weights, (7) the relative bonds of chemical reactions, (8), oxidation reduction reactions, (8) solubility, insolubility, calculation of solubility constant and factors affecting solubility, (9) the various methods of titrating precipitation and measuring turbidity, (10) measuring pH of solutions using paper and electrodes after standardizing them, (11) using instruments (and operating equipments) of volumetric and weighing analysis, and (12) the use of ultraviolet and visible spectrography and flame and atomic absorption chromatography.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
HUMAN BODY STRUCTURE AND FUNCTION: Basic human anatomy and physiology	PA-NAT-126	2/Block -5 weeks	6

Upon the successful completion of this course the student will be able to: (1) 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, with some formal laboratory sessions, and a self-directed optional human anatomy laboratory is running all the time for independent study, (2) fundamentals of human 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 emphasizes: (3) the characteristics, features and functions of neurons, ganglia, synapses, neuroeffector autonomic nervous system and somatic reflex arch, (4) the concepts, definitions, processes and mechanism of membrane potentials, somatic and autonomic transmission, receptor activation and production of response, (5) the structure, organization and regulation of adrenergic and cholinergic systems, (6) mechanisms (pathophysiology) of diseases related to cholinergic system (e.g. myasthenis gravis, periopheral neuropathy and diarrhea) and adrenergic system (e.g hypotension, pheochromocytoma and asthma), and (7) an introduction to drugs affecting the autonomic system, their mechanism of action, metabolism, side effects, structure-activity relationships and some clinical applications.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
HUMAN GENETICS	MLS-GEN-127	2/Block 2 weeks	2

This is a two-week-block module that covers the general principles of human genetics and its applications on health. The details include: (1) the biological functions of cells, (2) nucleic acids, (3) protein synthesis and its control, (4) mutation and genetic engineering and its practical applications in laboratory procedures and genetic diseases, (5) Mendel's theory in inheritance, (6) the bases of molecular genetics in man, (7) chromosomes, DNA, the steps of transcription of information contained in DNA helix, the role of RNA and ribosomes in manufacturing

enzymes and protein, (8) classification of genetic disorders and mention their clinical significance, (9) outline of the main chromosomal abnormalities and how they occur and the congenital errors they lead to, (10) an attempt to recognize the normal and abnormal chromosome patterns and (11) the latent effect of chemical, physical and constitutional factors on embryological development.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
MEDICAL TERMINOLOGY	SUM-ELEC-131	3/Block	2

This is a two-credit elective Summer block module that covers the linguistic structural basis for scientific and medical terminology in Latin and English and explanation of the main terms in the different applications of the medical science specialties to enable advanced students in different branches and graduates deal easily with physicians and other workers in the different specialties. The course also aims at acquainting students with the pronunciation, writing and understanding of general principal medical terms corresponding to their Arabic homologues. .

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
HEALTH CARE SYSTEM	SUM-ELEC-132	3/Block	2

This is a two-credit elective Summer block module that introduces: (1) the concept of health and factors affecting it, (2) the general hierarchy of health services and their current and future needs, (3) ethics of practice of the different health professions, (4) health management, (5) the health team and the principles of organization and control of the team, (6) the meaning of supervision and leadership, (7) the principles of organizational ethics, (8) the levels of health care, (9) quality and describe how to achieve in health care services, and (10) the instruments used and advantages gained when quality of health care is achieved.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
BASIC LABORATORY SKILLS	MLS- SKIL-211+221+311+321	3,4,5 &6/ Longitudinal	2 each semester

This is a two-hour weekly session during semester 3-6 to include: (1) communication skills of speaking, hearing, listening, recognizing strengths and weaknesses of close-ended and open-ended questions, non-verbal communications, establishing rapport, interview and be interviewed, dealing with a difficult patient, (2) taking brief relevant history from patients and relatives, specifically if the procedure requires certain patient fitness (e.g. bleeding tendencies..etc), inspect superficial veins and carry out safe phlebotomy, palpable arteries, and accurately take pulse, and measure blood pressure, (3) take venous blood and recognize normal blood cells, basic blood tests for respiratory disease, safety measure in blood taking, administering IV fluids, (4) prepare sputum for detection of mycobacteria, (5) prepare sera and perform common microbiological, chemical, parasitological, hematological and histopathological examination and interpret findings (6) develop basic life support skills.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
PRINCIPLES OF DISEASE	ME-DIS-212	3/6 weeks	6

This is a six-week block 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 and neoplasms.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
STERILIZATION, DISINFECTION AND LABORATORY SAFETY	NUR-STR-213	3/Block - 3weeks	3

This is a three-week block-module which defines the terms sterilization, disinfection and antiseptics, and details the methods used in sterilization (heat, ionizing radiation, filtration, gaseous chemical agents, liquid chemical agents.. etc), measurement of microbial death, resistance to sterilization and disinfection and equipments used. The graduate technologist should know the appropriate methods for sterilization of various types of material and instruments.

This is module also includes: (1) emergency preparedness, (2) autoclave safety, (3) biosafety, (4) carcinogens, (5) chemical labeling procedures, (6) reactive chemicals, (7) material safety data sheets, (8) construction project design considerations, (9) eyewash and safety shower information, (10) flammable liquid storage, fire safety, (11) fume hood procedures and practice, (12) gas cylinder safety, (13) glass disposal, (14) sharps disposal, (15) lazer safety, (16) occupational safety, (17) personal protective equipment, (18) radiation safety program, (19) vacuum systems and (20) hazardous material shipping and transportation.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
BASIC HEMATOLOGY	ME-HEM-316	3/Block - 4 weeks	4

This is a four-week-block module which covers the basics of hematology and stages of hematopoiesis and the factors affecting it and the different types of anemia. The study also includes the chemical structure, synthesis, functions and genetic defects of hemoglobin and types of white blood cells and laboratory methods of diagnosis acute and chronic leukemias and the mechanism of blood clotting and coagulation and the laboratory methods of studying it. The course also covers the primary and secondary blood groups and their antibodies and their clinical use, precautions of blood transfusion and methods of detecting antibodies and determining the resulting complications of mismatching the different blood units. It also covers the organization of hematology laboratory and blood banks of Hospital including ways of collecting, transferring, registering the different blood samples and recording results and interpreting them and confirming quality control test. The course also includes student contribution to the different ways of preparing blood derivatives and identifying the possible complication on transfusing blood.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
PATHOPHYSIOLOGY	NUR-PATH-215	3/Block - 3 weeks	3

This is a three-week-block module that reviews the histological structure of the different body systems and their physiological actions and the relation to appearance of disease manifestations at the levels of the organs forming these systems, then how to recognize the disease characteristics out of disease causes and morphology and the ways of diagnosis and brief account on the famous management. This course is also associated with laboratory study of the gross and microscopic appearance of the affected organs. The details include outlines of: hypoxia- its causes, mechanisms and effects, causes of systemic injuries and their mechanisms, proliferation, hyperplasia, hypertrophy and the mechanism of each, the vascular changes accompanying inflammation, the chemical mediators of inflammation, the effect of inflammation on the different body systems, the mechanisms of tissue adaptation, and the mechanisms of the common diseases and their effects on the functions of the following systems: digestive, respiratory, cardiovascular, skeletal, nervous, endocrine and urogenital systems.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
CLINICAL BIOCHEMISTRY	MLS-CCHM-216	3/Block - 3 weeks	3

A three-week block module that course covers the chemical aspects of medical laboratory analyses that include glucose, amino acid, triglyceride and cholesterol blood concentration and the effect of change of their blood levels. It also covers blood ions and their effect on body functions and their disorders and measurements. The course also covers parts linked to liver & kidney functions and measurement of blood urea and creatinine. The detail include: uric acid in blood and urine, principles of investigation of drug concentration in blood, urine and investigation of poisoning, separation of blood proteins and hemoglobin types by electrophoresis, ferritin measurement in blood, hemoglobin measurement, ability to outline poisoning investigations, and use and maintain equipments in clinical biochemistry.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
SYSTEMIC PATHOLOGY	MLS-PATH-222	4/Block - 5 weeks	5

This is a five-week-block module that reviews the general pathology in Module ME-DIS-212, and expands on the topics of systemic pathology with specific emphasis on the following diseases in each system: (1) respiratory-respiratory failure or low level of blood oxygen, chronic obstructive airway disease, granulomatus and neoplastic diseases in the lungs, (2) circulatory system- hypertension, valvular and ischemic heart disease (3) alimentary tract and associated organs- malabsorption, diseases of peritoneum, GIT bleeding, peptic ulcer, jaundice and liver diseases, cholecystitis, pancreatitis, (4) endocrine diseases diabetes, (5) renal and urinary organs' disease , (6) reproductive system- prostatic diseases, infertility, gynecologic pathology, (7) CNS- cerebrovascular accidents, CNS infection, neurodegenerative diseases, neurotoxic diseases, disorder of muscles, (8) skin- infections of the skin, dermatitis, tumors and miscellaneous skin conditions, (9) bones and joints- metablic bone diseases, bone infection, bone tumors, joint diseases, (10) miscellaneous multi-system- systemic lupus erythematosus, rheumatoid disease, amyloidosis, inherited metabolic diseases

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
BASIC IMMUNOLOGY	MLS-IMU-223	4/Block - 4 weeks	4

This is a four- week-block module which presents detailed description of the structure of the immune system and its tissues and its cellular properties and functions and the chemical elements of the immune system especially cytokines. The course also includes defining innate and acquired immunity and its types and the different mechanisms of immune response, hypersensitivity and its types, mechanisms and diagnosis. The course also gives detailed explanation of the immunity against microbial insult and methods of prophylaxis, serological and immunological diagnosis of microbial infection, immunodeficiency diseases and its diagnosis and the mechanisms of vaccine and toxoid action and the way of their preparation and utilization for prophylaxis and treatment. Students are also trained to using laboratory equipment related to immunological and biocellular diagnosis as ELISA and PCR.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
SEROLOGY AND CLINICAL IMMUNOLOGY	MLS-SER-224	4/Block - 4 weeks	4

This is four-week-block module in which students are introduced to applied aspects of the immunological processes; clinically and serologically. Explanation of immunological basis of the clinical condition is presented and the common laboratory serological tests related to the immunological phenomena are also studied. The technologist should be able to perform routine serologic tests for specific disease entities, fluorescent procedures according to the established laboratory guidelines, Utilize appropriate samples and controls of serological kits, correctly perform the tests, according to the manufacturer's instructions, and report the findings,

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ADVANCED PARASITOLOGY	MLS-PAR-225	4/Block - 5 weeks	5

This is a five- week-block module that reviews the basics of parasitology which includes classification of clinically important parasites: endoparasites, tapeworms, round worms and schistosomes in addition to exoparasites, and study of life cycles and ways of occurrence of disease together with brief clinical description and determining the most suitable clinical specimens for laboratory diagnosis using the light microscopy and other laboratory tests. Students are practically trained to methods of diagnosis that include direct light and electron microscopic examination and centrifugation and immunoserological methods including ELISA and PCR. It includes also: the basics of using fixatives and sample processing, suitable methods of collecting worms, assessing parasite load, performing concentration method to examine eggs and parasites, preparation of blood smears and identify blood parasites, with special emphasis on prevention and diagnosis of malaria.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
RESEARCH METHODOLOGY [INTRODUCTION TO RESEARCH]	ME-RES-227	4/Block - 2 weeks	2

This is a two- week-block module which focuses on the synthesis of professional knowledge, the skills and the attitudes in preparation for professional employment and life-long learning, Students are trained to perform a small research project on one topic of the medical laboratory sciences, that enables them to collect data, review literature, obtain results and discuss their findings in the form of presentations. The student should: (1) describe research methodology, write a meaningful proposal and generate a hypothesis, (2) collect up-to-date information on a particular topic, using proper sampling techniques, (3) execute the research and analyze the data collected, (4) discuss the results obtained with relevant literature and reach conclusions, (5) write down a research paper, and (6) present the findings in front of the class and discuss with colleagues and staff.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
CLINICAL CHEMISTRY	MLS-CCHM-312	5/Block -6 weeks	6

This is a six- week-block module that discusses the role of clinical chemistry in medicine and explains terms and units used in the subject. It focuses on the principle of reagent preparation and storage, identification and description of various types of specimens used in clinical laboratories, with particular emphasis on the analysis of urine, semen, plasma proteins, carbohydrates, enzymes and electrolytes.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ADVANCED MICROBIOLOGY	MLS-MICR-313	5/Block -4 weeks	4

This is a four-week-block module that covers the ways of collecting specimens for clinical microbiological investigation and selecting the growth media and their basic components and assuring vaccination and sterilization for microbial decontamination and the precautions for to be followed on dealing with biologically hazardous sources in microbiological laboratories and the selection of proper specimens for anaerobic culture. The details include: proper steps for sampling, handling and investigation, differentiation between suitable and unsuitable samples, the growth media and how to identify them, sterilization techniques, decontamination, the

precautions for dealing with biological hazards, proper samples for anaerobic culturing, the basic methods for recognizing Gram negative and positive organisms and the means of getting pure growths from mixed growths culture media. Reading Material College Notes Medical Microbiology, Greenwood+Slack+Peutherer+Barer, Churchill, 978-0443102103

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ADVANCED HEMATOLOGY	MLS-HEM-314	5/Block -4 weeks	4

This is a four-week block module during which the basic hematology is reviewed and the basic principles of hematological disorders are introduced, those are: anemias, leukemias, coagulopathies and their causes, diagnostic workup with emphasis on the laboratory procedures and how the laboratory results are interpreted and audited. The hematology laboratory setup will be outlined, at this stage.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
CYTOLOGICAL AND HISTOPATHOLOGICAL TECHNIQUES	MLS-HIST-315	5/Block -6 weeks	6

This is a six-week-block module. It covers: (1) the basics of tissue preparation for light microscopy, (2) cellular and tissue decay and basics of tissue fixation: types of histological cytological fixatives, (3) the processes of dehydration, clearing and embedding in paraffin wax and the other embedding media and (4) tissue sectioning. It also covers (5) the basics of cytological and histological staining and the common techniques for special staining of cells and tissues and how to prepare these stains. It describes (6) the non sectioning methods for processing cells and tissues for light microscopy such as smears and imprints, (7) training on equipments of histological techniques as tissue processors, embedding centres, rotary and automatic microtomes, multi-programme automatic linear and rotary slide stainers and cover slippers, (8) the basics of immunohistological staining, (9) performing immunohistological staining, (10) identifying results, and (11) applying safety measures in histology laboratories.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
MOLECULAR BIOLOGY AND TECHNIQUES	MLS-HIST-322	6/Block -5 weeks	5

This is a five-week-block module in which students are trained technically in the practical aspects of molecular biology. They are supposed to review genetics which they did earlier, and gain a thorough understanding of the biological systems amenable to such analyses. These systems cross all disciplines and include: (1) molecular genetics of bacteria and viruses, with emphasis on genes and molecules that enable these microbes to cause disease, (2) mechanisms and consequences of changes in gene expression during development, differentiation, and disease, (3) regulation of cell growth, behaviour, and interactions with other cells and the extracellular matrix, (4) regulation of the immune system which influences disease susceptibility/resistance, (5) development through evolution of gene sequences and of anatomical form, and (6) a review of the biochemistry of gene replication and recombination.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
COMMUNITY MEDICINE	MLS-COM-323	6/Block -4 weeks	4

This is a four-week-block module which reviews: (1) the health system, (2) the socioeconomic, psychological, behavioural and environmental factor related to epidemiology of disease and affecting its management, and

(3) primary health care. Most of the time is this course is devoted to (4) visits to health centres and villages working to (a) understand the health problems, (b) help the local people and authorities in suggestions and involvement in solving them, not only the investigative and diagnostic aspects, but the preventive and health promotion activities. This is possible through the study of: (5) epidemiology, (6) health system research (research for health), and (7) the methods used in community medicine to investigate epidemics, (8) maternal and child health, and (9) control of endemic and communicable diseases.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
MEDICAL ETHICS	ME-ETHIC-324	4/Block -2 weeks	2

This is a two-week-block module in which 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 Fiqh 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 controversialities of vitro fertilization, transplation, brain death, cloning, genetic engineering. Students should be aware of the (9) Figh 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.

Reading Material:

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
IN-SERVICE TRAINING	MLS-TRN-325	6/Block -4 weeks	4

This is an exposure to actual training in health institutions in laboratory technology. It includes sending students to well equipped and served hospital to learn how MLS is practiced, and spend a four-week apprentice period where they observe, perform and present actual service under supervision of senior technologists and physicians. Specific detailed logbooks are designed to assure standardized training. During semester 7 and 8 the student spends 40% of their credits in this type of training.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
LABORATORY MANAGEMENT AND QUALITY ASSURANCE	MLS-QUAL-326	6/Block -3 weeks	3

This is a three- week-block module which focuses on the: (1) detailed attitudes, skills and knowledge essential for leadership, (2) management and change of management in the medical laboratory environment. The students, after having a good theoretical base, should: (3) examine and critique the principles and practice of quality management, (4) quality assurance, (5) information technology, (6) technical procedures, (7) economic protocols and (8) laboratory accreditation.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ADVANCED IMMUNOLOGY	MLS-MICR-411	7/Block 6 weeks	6

This is a six-week-block module which: (1) reviews basic immunology (structure and function of the immune system) and (2) addresses the immunological defects and disorders including: (a) hypersensitivity reactions, (b) autoimmune disease, (c) transplantation rejection, and (d) immunodeficiency disorders. It includes (3) tumor immunology, (4) antigen presentation, (5) major histocompatibility complex molecules, (6) detection of lymphocytes and (7) complement deficiency.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
PRIMARY CARE CLINICAL CHEMISTRY	MLS-CCHM-411	7/Block -4 weeks	4

This is a four-week block module which considers: (1) the local laboratory procedures at the primary level, (2) the reasons that they are considerably less advanced than those used at hospital laboratories, (3) learning to perform an increasing number of laboratory tests apart from the routine analyses of ESR, hemoglobin, glucose and microscopic cell count, (4) learning how these additional tests are done and the possible sources of errors, like the test strip analyses, analyses for monitoring a disease which might prevent or decrease complications, (5) accessing and harmonizing with the nearest hospital care, (6) applying continuous method assessment protocols for quality assurance under advisory boards, (7) observing continuity of primary care and keeping medical records, using the patient as his/her source of reference. Staff should seek opportunities for continuing education to optimize the use of clinical chemistry in primary care in order to keep total cost of primary care down.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
MEDICAL ENTOMOLOGY	MLS-PAR-411	7/Block -2 weeks	2

This is a four-week-block module concerned with the (1) study of insects and arthropods (vectors) that have an impact on human health, (2) the transmission of protozoa, viruses, bacteria and worms, that mainly affecting the blood and intestinal tract, (3) study of the habitat, geographical distribution and morphology of vectors, and (4) the surveillance and control methods used at the personal or environmental levels.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
HEMOSTASIS AND BLEEDING DISORDERS	MLS-HEM-411	7/Block -4 weeks	4

This is a four-week block-module that covers the: (1) factors that control hemostasis, (2) natural mechanisms of blood clotting, (3) clotting antagonists, (4) carrying out tests necessary to reveal the platelet count and functions, (5) investigations and tests necessary to diagnose cases of bleeding tendencies, (6) investigations and examinations necessary to diagnose cases of blood clotting, (7) studying prothrombin and fibrinogen, (8) explaining the mechanism of platelet clot and its various components, (9) blood sampling methods, and (10) performing the necessary investigations to follow patients of anti-clotting clinics.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
CYTOLOGY AND CYTOLOGICAL TECHNIQUES- PRACTICAL ASSIGNMENT	MLS-HIST-411	7/Block -4 weeks	4

This is a four- week-block module which covers: (1) a review of the theoretical and practical aspects related to cell cycle, (2) cell renewal, replication, proliferation and neoplasia, (3) the chemical factors related to carcinogenesis, (4) classification of cancers and stages of its formation and its different histological features, (5) the methods of getting cells for microscopical examination including desquamated cells, needle aspiration and biopsies, (6) methods of laboratory diagnosis of different tumors including light and electron microscopy and (7) the immunohistological and cytological methods.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ADVANCED BACTERIOLOGY	MLS-MICR-412	7/Block -6 weeks	6

This is a six- week-block module for the detailed study of (1) groups of staphylo- and strepto-coccal bacteria, bacilli, mycobacteria tuberculose and mycobacteria leprae, (2) acquired and non acquired bacteria, their morphology, functional and biochemical structure, (3) methods of causing disease, (4) the best ways of getting clinical specimens for isolating the microbe, (5) culture types of enterobacteriae, pseudomonas, hemophilic bacteriae and bacteriae of whooping cough, intermittent fever, vibriocholerae, helicobacter, mycoplasma, chlamydiae, rickettsiae, (6) anaerobic coccal and bacillary sporing and non sporing bacteriae, their cultures and growth requirements, the characteristic biochemical reactions and characteristic serological tests in addition to routes of infection, control and prophylaxis, (7) the ways of evaluating efficacy of antibacterials and the mechanisms of their effects, (8) bacterial resistance, and (9) relationship of the host and the microbe.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ADVANCED CLINICAL CHEMISTRY	MLS-CCHM-412	8/Block -4 weeks	4

This is a four- week block-module which offers detailed study of the (1) common measurement methods used in laboratories for carbohydrates, amino acids, proteins, lipids, (2) liver function tests, (3) kidney function tests, (4) blood gases and pH, (5) digestive system and endocrine glands and the diseases associated with them, (6) enzyme concentration ANF, LDH and CK and their relation to angina pectoris and heart disease, (7) blood calcium level, (8) blood iron level, (9) serum amylase concentration, (10) amino acids, (11) clinically relevant hormones measurement by various methods, G6PD, (12) concentration of trace amounts of clinically relevant metals, (13) analysis of kidney and gall bladder stones, (14) analyses of cerebrospinal fluid biochemical components, (15) concentration of the types of lipoproteins, (16) analyses of seminal fluid, (17) PCR, and (18) dealing with automatic equipments and those using dry chemical kits.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ADVANCED PARASITOLOGY AND IMMUNOPARASITO-LOGY	MLS-PAR-413	7/Block -8 weeks	8

This is an eight- week-block module that: (1) reviews the basic parasitology and (2) introduces clinical methods in managing problems of patients with parasitic disease, starting with (a) the medical history and (b) physical signs, (c) relevant laboratory investigations, correlating that with patient conditions, and (d) studying the appropriate

parasitic treatment and effects of various medications on the investigative profile of the patient.

The module includes immunoparasitology a new term which was addressed as malaria and leishmania cell biology and immunology, molecular parasitology and mammalian genetics. It concentrates on: (1) molecules and processes involved in immunity and drug-resistance of parasites like malaria and leishmania, and expanded to include *Toxoplasma gondii*, an important pathogen in AIDS patients, (2) genome mapping of parasites and (3) immunogenicity trials of vaccines.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ANEMIAS AND HEMOGLOBIN DISORDERS	MLS-HEM-412	7/Block -6 weeks	6

A four- week-block module which deals with clinical and laboratory presentations of iron deficiency, sideroblastic, megaloblastic anemias autoimmune hemolytic anemias as well as anemias due to chronic disease. It deals with diagnostic features of the inherited genetic disorders in which either the quality or quantity of hemoglobin is abnormal, among them the most common are sickle and thalassemia. Students should know the follow up protocols of patients with such illnesses and outline the therapeutic approaches to each of them.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
HISTOPATHOLOGICAL TECHNIQUES	MLS-HIST-412	5/Block 8 weeks	8

An eight- week block module during which basic techniques done in Module MLS-HIST-315 are reviewed. The student carries out tissue preparation for light microscopy, using the appropriate tissue fixation from the various types of histological cytological fixatives, through the processes of dehydration, clearing and embedding in paraffin wax and the other embedding media and tissue sectioning. He/she should apply cytological and histological staining and the common techniques for special staining of cells and tissues and how to prepare these stains. The module also covers non sectioning methods for processing cells and tissues for light microscopy such as smears and imprints. Towards the end of this course students are expected to use and maintain the equipment of histological techniques as tissue processors, embedding centres, rotary and automatic microtomes, multi-programme automatic linear and rotary slide stainers and cover slippers, the basics of immunohistological staining, performing immunohistological staining and identifying results, and apply safety measures in histology laboratories.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ADVANCED VIROLOGY	MLS-MICR-413	7/Block -4 weeks	4

A four- week block module that deals with studying the groups of different viruses regarding definition, morphology, structure, replication, vital functions, classification, and ways of causing disease. A brief description of the clinical entities (e.g. hepatitis, influenza, herpes, polio- AIDs, etc)is needed to specify the type of specimens taken for laboratory diagnosis. It includes isolating the viruses in cell cultures, and studying the disease effects on cells, tissues, organs and systems of the body. It covers the use of electron microscopy, and serological tests used to identify the viruses (complement fixation, direct fluorescence, PCR etc). Studying the routes of infection is important for disease control and prophylaxis.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
CLINICAL CHEMISTRY AND PUBLIC HEALTH	MLS-CCHM-413	7/Block -4 weeks	4

A four-week-block module which discusses the controversial issue of relationship between the need and availability of clinical chemistry services. It requires student to study data from African countries and less-developed countries of the Western Pacific regions on the status of disease burden and the situation of available clinical chemistry research, collect local data on the services provided to rural health care facilities in the under-served areas of the country and suggest methods of introducing such servicing considering cost and priorities.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
TROPICAL DISEASES AND PUBLIC HEALTH	MLS-PAR-413	7/Block -4 weeks	4

A four-block module which concentrates on the study of parasitic tropical diseases in both theoretical and practical instructions. Such diseases are prevalent in tropical and subtropical regions, the methods of controls are more or less environmental associated with poor agricultural communities, and no vaccine are available so far. Malaria, trypanosomiasis, leishmaniasis, schistosomiasis, lymphatic filariasis and onchocerciasis are all common in Sudan and have to be reviewed using public health approaches and strategies of control including use of safe water, draining wetlands, application of insecticides, use of mosquito nets, development and use of vaccination, subsidizing treatment of cases, assist in the economic development of in the endemic regions.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
LEUKEMIAS AND LYMPHOMAS INVESTIGATIONS	MLS-HEM-413	7/Block -6 weeks	6

A four- week block module which addresses two major hematologic disorders. Students are expected to define, classify, identify risk factors, outline clinical features and diagnostic algorithms, perform and discuss laboratory investigation and outline management for leukemias and lymphomas. They should detail the description and recognize the microscopic features of all types before treatment, and the times of remissions and exacerbations.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
CYTOGENETICS AND MOLECULAR TECHNIQUES	MLS-HIST-413	7/Block -4 weeks	4

A four- week block module which goes beyond the introduction in Module MLS-GEN-127, in semester 2. The student should do by themselves the molecular techniques in cytogenetics, utilizing advanced laboratory facilities. This is a preparation for practice in in-service training during this semester.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
IMMUNOHISTOCHEMICAL TECHNIQUES- PRACTICAL ASSIGNMENT	MLS-HIST-413	7/Block -4 weeks	4

A four- week block module to study the localization of proteins in cells of a tissue section, making use of antibodies binding specifically to antigens in biological tissues, apply immunohistochemical staining to diagnose abnormal cells such as those found in cancerous tumors, find out specific molecular markers characteristic of important cellular events like cellular proliferation or death, understand the localization and distribution of biomarkers in biological tissues, and the method of visualizing antibody-antigen interactions like colour or fluorescence

(immunofluorescence) The module includes practical application of the direct and indirect immunohistochemical techniques and diagnostic immunohistochemical markers. This may include directing therapy of tumors through targeting hormone receptors and exploiting monoclonal antibodies.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
EVIDENCE-BASED PRACTICE IN MLS	MLS-MICR-414 MLS-CCHM-414 MLS-PAR-414 MLS-HEM-414 MLS-HIST-414	5/Block -2 weeks	2

This is a two-week-block module that covers the clinical approach of evidence-based laboratory technology as a means to deliver appropriate care in an efficient manner to individual patients. The student should explain: (1) why do we need it? (2) how to integrate research evidence? (3) how to ask the right questions? (4) searching the literature, (5) critical appraisal of the literature, (6) nature of qualitative research and how to appraise it, (7) systematic review, (8) meta-analysis, (9) developing evidence-based culture and (10) how clinical evidence can change laboratory practice.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
MYCOLOGY	MLS-MICR-421	8/Block -4 weeks	4

A four-week block module to study of the groups of fungi and yeasts regarding their classification, morphology, structural physiology, biochemical functions, methods of inducing disease. It includes brief clinical description of the diseases resulting from fungi, so as to decide on the most suitable samples from which to isolate the organisms and study their growth requirements. The laboratory technologist deals with the various pathological samples, carries out preservation steps, follows with the microscopical examination and serological testing necessary for the diagnosis. The details of these techniques are specially essential for the clinically important fungi.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
BASIC CLINICAL CHEMISTRY DIAGNOSIS	MLS-CCHM-421	5/Block -6 weeks	6

A six-week block module that reviews the basic Module MLS-CCHM-312 and discusses the role of clinical chemistry in diagnosis of specific disease entities, through clinical survey of patient problems and choice of appropriate investigation of liver function, renal function, blood gases or blood chemistry and provide interpretation of the laboratory results.

The module includes a review of enzyme classification, basic molecular structure, functions and clinical importance. It also includes the nomenclature, sources, classes, functions and methods of hormonal assays. It outlines the immunological techniques of investigating and diagnosing disorders of enzymes and hormones.

The diagnostic conclusions should be always audited by a qualified pathologist and/or clinician supervising the technologist

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
BASIC PARASITOLOGICAL DIAGNOSIS	MLS-PAR-421	7/Block -6weeks	6

A SIX-week block module that reviews the basic and clinical parasitology in Modules ME-PAR-125 and MLS-PAR-412, and introduces specific disease problems with clinical history for the students to make appropriate choice

of laboratory investigations, show competence in carrying out these investigation through correct procedures and techniques and interpret the results and advice the patient on further steps of management in close contact with the supervising pathologist and/or clinician. The modern diagnostic molecular and immunological techniques should be included in student choice of investigation with realistic economic considerations and patient's capabilities and safety. The diagnostic conclusions should be always audited by a qualified pathologist and/or clinician supervising the technologist

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
BASIC HEMATOLOGICAL DIAGNOSIS	MLS-HEM-421	8/Block -6 weeks	6

A six- week block module that describes the essential aspects of diagnosing hematologic disease, through an outline of clinical features and diagnostic laboratory criteria which have been detailed in earlier courses. It includes more recent sophisticated (molecular) diagnostic techniques in hematopathology, immunocytochemistry and immunophenotyping, in addition to the use of radioisotopes in the hematology laboratory, or other major emerging technologies before the student is graduated. It involves preparing blood and blood components for transfusion as well as selection of appropriate, compatible components for transfusion. It includes screening of potential donors and recipients for unexpected antibodies and to select blood which lack offending antigens. It addresses the immunological aspects of umbilical cord blood transplantation and bone marrow transplantation. The diagnostic conclusions should be always audited by a qualified pathologist and/or clinician supervising the technologist.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
BASIC HISTOPATHOLOGICAL DIAGNOSIS	MLS-HIST-421	8/Block -6 weeks	6

A six- week block module concerned with the morbid anatomic and histological changes resulting from disease, including light microscopic appearance of inflammation, coagulation, consolidation, granulation, autolysis, tissue necrosis. It is the science of differentiating microscopically between normal and abnormal epithelial, connective, muscular and nervous tissues, the microscopical characteristics of the common diseases of different body systems and the microscopical manifestations of wound and bone healing and the basics of routine, special, immunological staining for examining diseased tissues. A technologist should name the lesions and diseases in various body regions, describe in detail the microscopical appearance of acute and chronic inflammation, appearance of necrosis and fibrosis, recognize the value and technical limitations of needle biopsies and the procedures to reach a diagnosis, and correlate pathological history, radiographs and gross and microscopical features to suggest a diagnosis. The diagnostic conclusions should be always audited by a qualified pathologist and/or clinician supervising the technologist

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
INFECTION CONTROL	MLS-MICR-422	8/Block -6 weeks	6

A six- week block module that deals with sources of infection in the community and health institutions, in particular as related to medical facilities, the measures of prevention, disinfection and sterilization, understanding the contagious and contaminating materials and the organisms likely to be transmitted from contacts with such material, identifying the potential sources of infection in laboratory and contamination of specimens, and appreciation the role of personal and laboratory safety measures. 11

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
CLINICAL CHEMISTRY EQUIPMENTS	MLS-CCHM-422	8/Block -6 weeks	6

A six- week block module that presents a description of the basics of automatic analysis of clinical analytical chemistry laboratories including technical study of the different apparatuses, their uses that includes the electronic principles of operating them and affecting the interpretation of results. This includes: flame spectrophotometer, spectrophotometers, immunofluorescence, fast adherence, interpreting mononucleosis test, Western blot test and interpreting the results, immunoblot analysis with care on patients specimens using automatic chemical analyzer, kinetic analyses of blood and other body fluids, immune diffusion osmotic measurement equipment, operating electrophoresis, ELISA and interpreting the results, PCR equipment and interpreting the obtained results, operating gas analyzers and chromatography. The technologist should be aware to identify the equipment problem before starting the test and keep inventory of manufacturer and maintenance details for each equipment.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
FIELD TRAINING IN PARASITOLOGY TECHNIQUES/ INFECTION CONTROL	MLS-PAR-422	8/Block -6 weeks	6

A six- week block module based in the community or hospital using a logbook and carrying out supervised parasitological examination and recording results. The contents of the logbook will be designed according to the common investigations in the country. The list should include testing skills related to prevention, eradication or control of parasitic infections, as seen by experts from the National Programmed in the Ministry of Health.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
FIELD TRAINING IN CLINICAL HEMATOLOGY/ BLOOD BANKING	MLS-MEM-422	8/Block -6 weeks	6

A six- week block module. based in the community or hospital using a logbook and carrying out supervised hematological examination and recording results. The contents of the logbook will be designed according to the common tests used in the country. The list should include testing skills related to prevention and control of blood diseases, as seen by experts from the National Programmed in the Ministry of Health.

This course covers the basis and practice of blood banking and blood transfusion. The course reviews understanding blood group immunology, precautions of blood transfusion and methods of detecting antibodies and determining the resulting complications of mismatching the transfused blood.. It also covers the organization of hematology laboratory and blood banks in hospitals including methods of collecting, transferring, registering blood samples and recording results and interpreting them, assuring quality control of all tests. The student assumes active role in preparing blood derivatives.

This module may also include a revision immunohematology which deals with preparing blood and blood components for transfusion as well as selection of appropriate, compatible components for transfusion. It includes screening of potential donors and recipients for unexpected antibodies and to select blood which lack offending antigens. It addresses the immunological aspects of umbilical cord blood transplantation and bone marrow transplantation.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ELECTRON MICROSCOPICAL TECHNIQUES	MLS-HIST-422	8/Block -2 weeks	2

A two- week block module that includes the theoretical aspects of transmission and scanning electron microscopes noting the similarities and differences, and the methods of manual preparation of biological specimens for examination by each. This includes preparing fixatives such as glutaraldehyde, paraformaldehyde and metastaining with osmium tetra-oxide, dehydration, clearing and embedding in resins, types of resins,

ultramicrotomy, staining. It covers the technique of using the ultramicrotome, producing ultrathin sections and staining with uranium acetate, and lead citrate. It involves training students to equipment for automatic preparation of histological and cytological specimens for electron microscopy and use of the automatic stainer. It also includes preparation of photographs, the common immunocytological staining methods for electron microscopy and applying safety measures in electron microscopy units..

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
LABORATORY MANAGEMENT AND ECHONOMICS	MLS-MICRO-423 MLS-CCHM-423 MLS-PAR-423 MLS-HEM-434 MLS-HIST-434	8/Block -2 weeks each	2 each

A two- week block module that presents detailed description of clinical laboratories management and planning regarding specimen collection, transport and storage and performing the different quality control tests beside studying communication means and analysis and recording the provisional results. The module also includes applying quality control to equipment and adopting safety procedures of clinical laboratories. The details include a short course on general management, administrative organization, laboratory forms, written procedures for collecting and transporting specimens, protocols of safety, quality control tests, and all economical studies to ensure the feasibility and utilization of services and their cost for the public and owners, especially in complete or partial research laboratories.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
HEALTH INFORMATION SYSTEM	MLS-MICR-424 MLS-CCHM-424 MLS-PAR-424 MLS-HEM-424 MLS-HIST-424	8/Block -2 weeks each	2each

A four- week block module which introduces health information system (HIS) – terminology, classification and setup. The students need to spend sometime in the relevant department in the Federal and State Ministry of Health to see how the data is collected and compiled. It includes also the internet sources of HIS, they should prepare a critique of the current systems and suggest a design or protocol for better organization and computation of the laboratory data collected.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
GRADUATION PROJECT	MLS-RES-425	8/Block -4 weeks	4

A four- week FREE block module reserved to writing a short thesis, which can be a review or experimental research. No formal didactic timetable is needed since students had a previous course on research methodology. Students will contact their supervisors to decide on the topic title, and advise students to start and progress in writing. The cost of research and examinations is the responsibility of the candidate.