

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 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 through 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 post grad studies to obtain master's degree MLS honor or PhD in the field of medical 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.

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 bachelor 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 ultra structural 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 centers 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 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 centered 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.

Semester 1 [21 CHs- 18 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	English Language-1	MLS-ENGL-111	Longit.	3	-	-	3
2	Human Genetics	MLS-GENE-112	Longit.	2	-	-	2
3	General Chemistry	MLS-GCHM-113	Longit.	2	-	1	3
4	Physiology -1	MLS-PHYS-114	Longit.	2	-	-	2
5	Basic Biochemistry	MLS-BIOC-115	Longit.	3	-	-	3
6	Computer Sciences	MLS-COMP-116	Longit.	2	-	1	3
7	Anatomy	MLS-ANAT-117	Longit.	2	-	1	3
8	Physics for Medical Equipment and Investigations	MLS-PHYS-118	Longit.	2	-	-	2
				18		3	21

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

Courses or examinations for late comers and failures

Semester 2 [20 CHs- 18 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	English Language-2	MLS-ENGL-121	Long.	3	-	-	3
2	Physiology -2	MLS-PHYS-122	Long.	3	-	-	3
3	Biochemistry (Metabolism)	MLS-BIOC-123	Long.	2	-	-	2
4	Histology	MLS-HHIST-124	Long.	2	-	1	3
5	Lab Safety	MLS-SAFE-125	Long.	2	-	-	2
6	Introduction to Medical Ethics	MLS-ETHI-126	Long.	2	-	-	2
7	Introduction to Medicine and Medical Education	MLS-MEDU-127	Long.	2	-	-	2
8	Clinical Laboratory Mathematics	MLS-MATH-128	Long.	1	-	-	1
9	Biostatistics	MLS-STAT-129	Long.	2	-	-	2
				19	-	1	20

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 –w ord 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 [20 CHs- 20 weeks]

	Title	Code	Weeks	Units			CHs
				Th	Tut	Prac	
1	Basic Professional Skills-1	MLS-SKIL-211	Long.	-	-	2	2
2	Introduction to MLS	MLS-INTR-212	2	2	-	-	2
3	Basic Immunology	MLS-IMUN-215	3	2	-	1	3
3	Basic Pathology	MLS-PATH-213	2	3	-	-	3
4	Basic Haematology	MLS-BHEM-214	5	2	-	2	4
6	Serology and Immunohaematology	MLS-SERO-216	2	1	-	1	2
7	Clinical Biochemistry-1	MLS-CCHM-217	6	2	-	2	4
			20	12	-	8	20

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

Semester 4 [21 CHs- 19 weeks]

	Title	Code	Weeks	Units			CHs
				Th	Tut	Prac	
1	Basic Professional Skills-2	MLS-SKIL-221	Long.	-	-	2	2
2	Basic Histology and Histological Techniques	MLS-HIST-222	5	2	-	2	4
3	Medical Entomology and Parasitology	MLS-PARA-223	2	2	-	1	3
4	Basic Microbiology	MLS-BMIC-224	4	2	-	2	4
5	Protozoology	MLS-PROT-225	4	2	-	2	4
6	Clinical Microbiology-1	MLS-CMIC-226	4	2	-	2	4
			19	10	-	11	21

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

SUMMAR 2 AND ELEVTIVE MODULES

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

Semester 5 [22 CHs - 20 weeks]

	Title	Code	Weeks	Units			CHs
				Th	Tut	Prac	
1	Basic Professional Skills-3	MLS-SKIL-311	Long.	0	0	2	2
2	Clinical Biochemistry -2	MLS-CCHM-312	6	3	0	3	6
3	Helminthology	MLS-HLMT-313	4	2	0	2	4
4	Cytological and Histopathological Techniques	MLS-CYTO-314	6	3	0	3	6
5	Clinical Microbiology-2	MLS-CMIC-315	4	2	0	2	4
			20	10	0	12	22

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

Repeat courses or examinations for late comers and failures.

Semester 6 [20 CHs- 20 weeks]:

	Title	Code	Weeks	Units			CHs
				Th	Tut	Prac	
1	Basic Professional Skills-4	MLS-SKIL-321	Long.	0	0	2	2
2	Public Health	MLS-PUBH-322	3	2	0	0	2
3	Laboratory Management and Quality Assurance	MLS-QUAL-323	3	2	0	0	2
4	Advanced Haematology	MLS-HEMA-324	6	3.5	0	3.5	7
5	Molecular Biology and Techniques	MLS-MLBT-325	3	2	0	1	3
6	Introduction to Research	MLS-RESH-326	2	2	0	0	2
7	In-Service Training	MLS-TRIN-327	3	0	0	2	2
			20	11.5	0	8.5	20

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.

Semester 7 [20 CHs – 20weeks] and Semester 8 [22 CHs- 20 weeks]

Examinations (2weeks)

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

Clinical Chemistry	Haematology and Immunohaematology	Histopathology and Cytology	Microbiology and Clinical Immunology	Parasitology and Medical Entomology
Semester 7				
Primary Care Clinical Chemistry MLS-CCHM-411 6 CHs (6 weeks)	Anaemias and Haemoglobin Disorders Investigations MLS-HAEM-411 8 CHs (8 weeks)	Cytology and Cytological Techniques MLS-HIST-411 5 CHs (6 weeks)	Immunological Techniques MLS-MICR-411 6 CHs (6 weeks)	Parasitology and Immunoparasitology MLS-PARA-411 8 CHs (8weeks)
Advanced Clinical Chemistry MLS-CCHM-412 6 CHs (6 weeks)	Leukaemias and Lymphomas Investigations MLS-HAEM-412 6 CHs (6 weeks)	Histopathological Techniques MLS-HIST-412 7 CHs (7 weeks)	Bacteriological Techniques MLS-MICR-412 8 CHs (8 weeks)	Tropical Diseases and Public Health MLS-PARA-412 8 CHs (8weeks)
Clinical Chemistry and Public Health MLS-CCHM-413 6 CHs (6 weeks)	Haemostasis and Bleeding Disorders Investigations MLS-HAEM-413 4 CHs (4 weeks)	Immunohistochemical Techniques MLS-HIST-413 4 CHs (3 weeks) Electron Microscopy Techniques MLS-HIST-415 2 CHs (2 weeks)	Mycology MLS-MICR-413, 4 CHs (4 weeks)	Medical Entomology MLS-PARA-413 2 CHs (2 weeks)
Evidence Based Practice in Medical Laboratory Sciences MLS-CCHM-414 2 CHs (2 weeks)	Evidence Based Practice in Medical Laboratory Sciences MLS-HAEM-414 2 CHs (2 weeks)	Evidence Based Practice in Medical Laboratory Sciences MLS-HIST-414 2 CHs (2 weeks)	Evidence Based Practice in Medical Laboratory Sciences MLS-MICR-414 2 CHs (2 weeks)	Evidence Based Practice in Medical Laboratory Sciences MLS-PARA-414 2 CHs (2 weeks)

Semester 8				
Clinical Chemistry Equipments MLS-CCHM-421 6 CHs (6 weeks)	Basic Haematological Diagnosis MLS-HAEM-421 6 CHs (6 weeks)	Cytogenetics and Molecular Techniques MLS-HIST-421, 6 CHs (6 weeks)	Virology Techniques MLS-MICR-421 6 CHs (6 weeks)	Basic Parasitological Diagnosis MLS-PARA-421 6 CHs (6 weeks)
Basic Clinical Chemistry Diagnosis MLS-CCHM-422 6 CHs (6 weeks)	Field Training in Clinical Haematology and Blood Banking MLS-HAEM-422 6 CHs (6 weeks)	Basic Histopathological Diagnosis MLS-HIST-422 6 CHs (6 weeks)	Infection Control MLS-MICR-422, 6 CHs (6 weeks)	Field Training in Parasitology Techniques and Infection Control MLS-PARA-422 6 CHs (6 weeks)
Laboratory Management and Economics MLS-CCHM-423 2 CHs (2 weeks)	Laboratory Management and Economics MLS-HAEM-423 2 CHs (2 weeks)	Laboratory Management and Economics MLS-HIST-423 2 CHs (2 weeks)	Laboratory Management and Economics MLS-MICR-423 2 CHs (2 weeks)	Laboratory Management and Economics MLS-PARA-423 2 CHs (2 weeks)
Health Information System MLS-CCHM-424 2 CHs (2 weeks)	Health Information System MLS-HAEM-424 2 CHs (2 weeks)	Health Information System MLS-HIST-424 2 CHs (2 weeks)	Health Information System MLS-MICR-424 2 CHs (2 weeks)	Health Information System MLS-PARA-424 2 CHs (2 weeks)
Graduation Project MLS-RESH-425 6 CHs (Longitudinal)	Graduation Project MLS-RESH-425 6 CHs (Longitudinal)	Graduation Project MLS-RESH-425 6 CHs (Longitudinal)	Graduation Project MLS-RESH-425 6 CHs (Longitudinal)	Graduation Project MLS-RESH-425 6 CHs (Longitudinal)

GRADUATION

OUTLINE OF COURSES

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

Title	Code	Semester/Duration	Credits
ENGLISH LANGUAGE-1	MLS-ENGL-111	1 /Longitudinal15 weeks	3

15 weeks longitudinal course .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.

Title	Code	Semester/Duration	Credits
HUMAN GENETICS	MLS-GENE-112	1 /Longitudinal15 weeks	2

A 15 weeks longitudinal course 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.

Title	Code	Semester/Duration	Credits
GENERAL CHEMISTRY	MLS-GCHM-113	1 /Longitudinal 16 weeks	3

This is a16 week's longitudinal courses focus on basic general chemistry, organic chemistry and analytical chemistry.

Title	Code	Semester/Duration	Credits
PHYSIOLOGY -1	MLPHYS-114	1 /Longitudinal 16 weeks	2

This is a 16 weeks Longitudinal .This course presents general concepts and principles that are basic to the functions of all body systems (2) It describes relationship between human and environment by studying: body composition and body fluids, transport across cell membrane, membrane potential, excitable tissues, autonomic nervous system and regulation of body temperature

(3) Additional aspect is to describe the physiological arrangement which serve to restore the normal state by understanding homeostasis and feedback systems (4) Students are required to describe and outlines the general organization and functions of blood system in terms of blood components, functions and typing, blood coagulation system and immunology (5) Apply phy siological knowledge in laboratory practice to solidify theoretical knowledge .

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
BASIC BIOCHEMISTRY	MLS-BIOC-115	1/Longitudinal 16 weeks	3

This is a 16 weeks longitudinal course focus on basic biochemistry of carbohy drates, proteins, lipids, nonprotein nitrogenous sub, vitamins enzymes hormones trace elements and buffer.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
COMPUTER SCIENCES	MLS-COMP-116	1/Longitudinal 16 weeks	3

This is a 16 weeks Longitudinal course focus on basic component of computers, identification of computer applications such as Word, Ex cel, PowerPoint, Access and Internet Ex plorer and application of computer in health sciences education.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ANATOMY	MLS-ANAT-117	1/Longitudinal 16 weeks	3

This is a 16 weeks longitudinal course focus on the gross anatomy of human body system especially the respiratory, cardiov ascular, digestive, urinary, reproductive, nervous and endocrine system.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
PHYSICS FOR MEDICAL EQUIPMENTS AND INVESTIGATIONS	MLS-PHYS-118	1/Longitudinal 16 weeks	2

This is a 16 weeks longitudinal course includes: (1) the basic principles of general physics important for the technical background of many medical equipments, and (2) physical chemistry, gas laws, and physics of light, and radiation.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ENGLISH LANGUAGE-2	MLS-ENGL-121	2/Longitudinal 15 weeks	3

This is a 15 weeks longitudinal course. The general objectives of this course include:(1) Understand sentences and frequently used expressions related to very basic personal and family information, shopping, local geography, employment etc (2)

Communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters (3) Describe in simple terms aspects of your background, immediate environment and matters in areas of immediate need.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
PHYSIOLOGY 2	MLPHYS-122	2/Longitudinal 15 weeks	2

A 15 weeks longitudinal course .This course presents physiological functions of each human body organs and systems (Cardio-vascular system, respiratory system, gastro-intestinal system, renal system and nervous system (2) it integrates the facts and concepts of physiology to explain health problems.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
BIOCHEMISTRY (METABOLISM)	MLS-BIO-123	2/Longitudinal 15 weeks	2

This is a 15 weeks longitudinal course .This course includes the study of metabolism such as (1) Carbohydrates, lipids, proteins and nucleic acids metabolism, as well as the study of (2) Vitamins function (3) Metabolic Effects of Insulin and Glucagon (4) Diabetes Mellitus (5) Obesity (6) Biotechnology and Human Disease.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
HISTOLOGY	MLS-HIST-124	2/Longitudinal 16 weeks	3

This is a 16 weeks longitudinal course. This course include : (1) The histological characteristics of epithelial, connective, muscular and nervous tissue (2) The histological characteristics of different body systems.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
LAB SAFETY	MLS-SAFE-125	2/Longitudinal 16 weeks	2

This is a 16 weeks longitudinal course.The general objectives of this course include : (1) Understand the overview of the field of medical laboratory technology (2) be familiarization with laboratory safety, safe laboratory design. (3) How to practice safe handling of pathogenic micro-organisms and their toxins in the biological laboratory that accomplished through the application of containment principles and the risk assessment, and (4) know how to prevent and/or minimize occupational and environmental exposure from hazardous materials usage and hazardous activities being conducted in the laboratory environment.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
INTRODUCTION TO MEDICAL ETHICS	ME-ETHI-126	2/Longitudinal 16 weeks	2

This is a 16 weeks longitudinal course focus on, (1) principle of ethical guidelines (2) History of medical ethics. (3) Health professional relationships (4) Ethics of medical research (5) Policy, laws in medical laboratories.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>

INTRODUCTION TO MEDICINE AND MEDICAL EDUCATION	MLS-MEDU-127	2/Longitudinal 16 weeks	2
--	--------------	-------------------------	---

This is a 16 weeks longitudinal course, 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) interdisciplinary and partnership concepts, (13) curriculum development, (14) program evaluation, (15) leadership and (16) professional ethics.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
CLINICAL LABORATORY MATHEMATICS	MLS-MEDU-128	2/Longitudinal 16 weeks	1

This is a 16 weeks longitudinal course, which includes: (1) Provides an opportunity to students to understand and internalize the basic mathematical concepts through concrete situations (2) Sound base for more abstract thinking (3) gives greater scope for individual participation.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
BIOSTATISTICS	MLS-STAT-129	2/Longitudinal 16 weeks	2

This is a 16 weeks longitudinal course 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>
BASIC PROFESSIONAL SKILLS	MLS-SKIL-211+221+311+321	3,4,5 and 6/ Longitudinal	2 each semester

These are two hours weekly longitudinal course, on which the students are introduced to basic skills in clinical chemistry, haematology, histopathology, microbiology and parasitology and its related laboratory investigations.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
INTRODUCTION TO MLS	MLS-INTR-212	3/ Longitudinal 13 weeks	2

This is a 13 weeks Longitudinal course, which introduces newly enrolled to the administrative professional and technical responsibilities of the medical laboratory technologists, the major technical areas are the basics and laboratory sciences: (1) parasitology (2) microbiology (3) clinical chemistry (4) haematology (5) histopathology, The professional competences include: (1) the organization of health system, hospital and laboratory (2) communication (3) legal and ethical issue (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 (4) observing the economic burden and impact of infra structure, 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>
BASIC IMMUNOLOGY	MLS-IMUN-215	3/ Longitudinal 13 weeks	3

This is a 13 weeks Longitudinal course, course 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) tumour 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>
BASIC PATHOLOGY	MLS-PATH-213	3/ Longitudinal 14 weeks	3

This is a 14 weeks Longitudinal course, include: (1) cellular injury, (2) cellular adaptation mechanisms (3) healing and repair (4) general pathology of inflammation, neoplasia and abnormal cell growth.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
BASIC HAEMATOLOGY	MLS-BHEM-214	3/ Longitudinal 14 weeks	4

This is a 14 weeks longitudinal course, which covers the basics of haematology and stages of haematopoiesis and the factors affecting it and the different types of anaemia. The study also includes the chemical structure, synthesis, functions and genetic defects of haemoglobin and types of white blood cells and laboratory methods of diagnosis acute and chronic leukaemias 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 haematology 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>
SEROLOGY AND IMMUNOHAEMATOLOGY	MLS-SERO-216	3/ Longitudinal 14 weeks	2

This is a 14 weeks longitudinal course is designed to give the student an introduction to the basic immunologic and genetic principles governing blood group systems and general aspects of blood transfusion practice.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
CLINICAL BIOCHEMISTRY-1	MLS-CCHM-217	3/ Longitudinal 14 weeks	4

This is a 14 weeks longitudinal course 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, introduction to instruments such as colorimeter and spectrophotometer identification and description of various types of specimens used in clinical laboratories, with particular emphasis on the analysis of urine (qualitative and quantitative analysis), plasma proteins and carbohydrates. Liver functions and liver function tests.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
BASIC HISTOLOGY AND HISTOLOGICAL TECHNIQUES	MLS-HIST-222	4/ Longitudinal 13 weeks	4

This is a 13 weeks longitudinal course. 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. It describes (6) the non sectioning methods for processing tissues for light microscopy such as smears and imprints. It covers the histological characteristics of different body tissues.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
--------------	-------------	--------------------------	----------------

MEDICAL ENTOMOLOGY AND PARASITOLOGY	MLS-PARA-223	4/ Longitudinal 13 weeks	3
-------------------------------------	--------------	--------------------------	---

This is a 13 weeks longitudinal course. 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. It 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>
BASIC MICROBIOLOGY	MLS-BMIC-224	4/ Longitudinal – 7 weeks	4

This is a 7 weeks longitudinal course that covers the ways of specimen collection for clinical microbiology investigation and selecting the growth media and basics components and assuring vaccination and sterilization for microbial decontamination and the precautions to be followed when dealing with biologically hazardous sources in microbiology lab. It describes the proper procedures for selecting the proper specimen for anaerobic culture including: proper sampling, handling and investigation, determining samples adequacy, sterilization techniques, decontamination, identifying gram positive and gram negative and the methods of isolating pure growth.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
PROTOZOLOGY	MLS-PROT-225	4/ Longitudinal 13 weeks	4

This is a 13 weeks longitudinal course that reviews the basics of parasitology which includes classification of clinically important parasites: endoparasites, in addition to exoparasite 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. 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>
CLINICAL MICROBIOLOGY-1	MLS-CMIC-226	4/ Longitudinal – 7 weeks	4

This is a 7 weeks longitudinal course provides the student with theoretical and practical knowledge about different medically important pathogens including: Gram positive cocci and Gram negative cocci, and their laboratory isolation and identification procedures.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
CLINICAL BIOCHEMISTRY-2	MLS-CCHM-312	5/Block – 6 weeks	6

A six-week block course covers the chemical aspects of medical laboratory analyses that include: lipids, non-protein nitrogenous substances, electrolytes, enzymes, vitamins. Principle of different instruments such as flame photometer, ion selective electrodes, immunological techniques, chromatography, electrophoresis and automation. Introduction to endocrinology and CSF analysis.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
HELMINTHOLOGY	MLS-HLMT-313	5/Block – 4 weeks	4

This is a four week-block module that review the basic of Helminthology which includes classification of clinically important metazoa : tapeworms, roundworms and schistosomes and study of life cycles and ways of occurrence of disease together with a brief clinical description and determines the most suitable clinical specimens for laboratory diagnosis using the light microscope and other laboratory test .student are practically trained to method of diagnosis that include light microscope examination and immunological methods include ELISA. it include also the basic of using fixative and sample processing ,suitable methods of collection worms, assessing parasite load performing concentration method to examine egg and parasites, preparation of blood smears and identify blood parasites with special emphasis on prevention and diagnosis of Schistosomiasis

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
CYTOLOGICAL AND HISTOPATHOLOGICAL TECHNIQUES	MLS-CYTO-314	5/Block -6 weeks	6

This is a six-week block course. It covers: (1) the basics of cytological and histological staining and the common techniques for special staining of cells and tissues and how to prepare these stains, (2) the non sectioning methods for processing cells for light microscopy such as smears and imprints, (3) training on equipments of histological techniques as tissue processors, embedding centres, rotary and automatic microtomes, multi-program automatic linear and rotary slide stainers and cover slippers, (4) the basics of immunohistological staining, (5) performing immunohistological staining, (6) identifying results, and (7) applying safety measures in histology laboratories.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
CLINICAL MICROBIOLOGY-2	MLS-CMIC-315	5 /Block – 4 weeks	4

This is a four week-block course during which the basic microbiological techniques reviewed and focus on the study of : (1) enterobactereas, acid fast bacilli and atypical bacteria including their morphology, functional and biochemical structure ,(2)

method of causing disease (3) a brief clinical description of disease to decide on the most proper sample from which to isolate the organisms and study their requirements. (4) exclusion and inclusion criteria in the reception of the sample, (5) introduction to virology and mycology, and (6) methods of isolating pure growth from mixed culture.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
PUBLIC HEALTH	MLS-PUBH-322	6/Block – 3 weeks	2

This is three week block course. They consist of theoretical studies on health system, the socioeconomic, psychological, behavioural and environmental factor related to epidemiology of disease and affecting its management, as well as primary health care. Most of the time is this course is devoted to weekly visits to health centres and villages trying to understand the health problems and help the local people and authorities in suggestions and involvement in solving them. This is possible through the study of epidemiology and health research, and the methods used in community medicine to investigate epidemics, maternal and child health, and control of endemic and communicable diseases.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
LABORATORY MANAGEMENT AND QUALITY ASSURANCE	MLS-QUAL-323	6/Block – 3 weeks	2

This is a three-week block course focused on: (1) Concepts of total quality management emphasized on laboratory management. (2) Phases of quality assurance (3) Types and implementation of quality control (4) Methods validation (5) Standard operating procedures (6) Accreditation of medical laboratories.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
ADVANCED HAEMATOLOGY	MLS-HEMA-324	6/Block – 6 weeks	7

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

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
MOLECULAR BIOLOGY AND TECHNIQUES	MLS-MLBT-325	6/Block – 3 weeks	3

This is a three week-block course 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, and (7) application of molecular techniques.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
INTRODUCTION TO RESEARCH	MLS-RESH-326	6/ Block – 2 weeks	2

This is a two week-block course 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>
IN-SERVICE TRAINING	MLS-TRIN-327	6/Block – 3 weeks	2

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 three-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.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
PRIMARY CARE CLINICAL CHEMISTRY	MLS-CCHM-411	7/Block – 6 weeks	6

This is a six-week block course 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, haemoglobin, glucose and microscopic cell count, (4) learning how these additional test 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>
ANAEMIAS AND HAEMOGLOBIN DISORDERS INVESTIGATIONS	MLS-HAEM-411	7/Block – 8 weeks	8

This is an eight-week block course which deals with clinical and laboratory presentations of iron deficiency, sideroblastic, megaloblastic anaemias, autoimmune haemolytic anaemias as well as anaemias due to chronic disease. It deals with diagnostic features of the inherited genetic disorders in which either the quality or quantity of haemoglobin is abnormal, among them the

most common are sickle and thalassaemia. Students should know the follow up protocols of patients with such illnesses and outline the therapeutic approaches to each of them.

Title	Code	Semester/Duration	Credits
CYTOLOGY AND CYTOLOGICAL TECHNIQUES	MLS-HIST-411	7/Block – 6 weeks	5

This is a six-week block course 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 microscopic examination including desquamated cells, needle aspiration and biopsies, (6) methods of laboratory diagnosis of different tumours including light and electron microscopy and (7) the immunohistological and cytological methods.

Title	Code	Semester/Duration	Credits
IMMUNOLOGICAL TECHNIQUES	MLS-MICR-411	7/Block – 6 weeks	6

This is a six-week-block course 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) tumour immunology, (4) antigen presentation, (5) major histocompatibility complex molecules, (6) detection of lymphocytes and (7) complement deficiency.

Title	Code	Semester/Duration	Credits
PARASITOLOGY AND IMMUNOPARASITOLOGY	MLS-PARA-411	7/Block – 8 weeks	8

This is an eight-week-block course 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.

Title	Code	Semester/Duration	Credits
ADVANCED CLINICAL CHEMISTRY	MLS-CCHM-412	7/Block -6 weeks	6

This is a six-week course 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 equipment's and those using dry chemical kits.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
LEUKAEMIAS AND LYMPHOMAS INVESTIGATIONS	MLS-HAEM-412	7/Block – 6 weeks	6

This is a six-week block course, which addresses two major haematological 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 leukaemias 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>
HISTOPATHOLOGICAL TECHNIQUES	MLS-HIST-412	7/Block – 7 weeks	7

This is a seven-week block course during which basic techniques done in Module MLS-CYTO-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-program 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>
BACTERIOLOGICAL TECHNIQUES	MLS- MICR- 412	7/Block – 8 weeks	8

This is an eight-week block course that covers the identification methods of Bacteria that cause infections in different body systems. It include the diseases, etiological agents, specimens collection, transportation and preservation and laboratory investigations of urinary tract infections, respiratory tract infections, skin infections, genital tract infections, central nervous system infections, blood circulation infections, gastrointestinal tract infections, water and milk examinations, methods of bacterial typing, methods of preservation of lab strains and

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
--------------	-------------	--------------------------	----------------

TROPICAL DISEASES AND PUBLIC HEALTH	MLS-PARA-412	7/Block -8 weeks	8
-------------------------------------	--------------	------------------	---

This is an eight-block course which focuses 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 is 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 the endemic regions.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
CLINICAL CHEMISTRY AND PUBLIC HEALTH	MLS-CCHM-413	7/Block – 6 weeks	6

This is a six-week block course 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>
HAEMOSTASIS AND BLEEDING DISORDERS INVESTIGATIONS	MLS-HAEM-413	7/Block – 4 weeks	4

This is a four-week block that covers the: (1) factors that control haemostasis, (2) natural mechanisms of blood clotting, (3) clotting antagonists, (4) carrying out test necessary to reveal the platelet count and functions, (5) investigations and test 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>
IMMUNOHISTOCHEMICAL TECHNIQUES	MLS-HIST-413	7/Block – 3 weeks	4

This is a three-week block course 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 tumours, 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 tumours through targeting hormone receptors and exploiting monoclonal antibodies.

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

A four-week block course 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

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
MEDICAL ENTOMOLOGY	MLS-PARA-413	7/Block – 2 weeks	2

This is a two-week block course 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>
EVIDENCE BASED PRACTICE IN MEDICAL LABORATORY SCIENCES	MLS-CCHM-414	7/Block – 2 weeks	2
	MLS-HAEM-414		
	MLS-HIST-414		
	MLS-MICR-414		
	MLS-PARA-414		

This is a two-week-block course 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>
ELECTRON MICROSCOPY TECHNIQUES	MLS-HIST-415	7/Block – 2 weeks	2

A two-week block course 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, ultra-microtomy, staining. It covers the technique of using the ultra-microtome, 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 stainers. It also includes preparation of photographs, the common immunocytochemical 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>
CLINICAL CHEMISTRY EQUIPMENTS	MLS-CCHM-421	8/Block – 6 weeks	6

A six-week block course 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>
BASIC HAEMATOLOGICAL DIAGNOSIS	MLS-HAEM-421	8/Block – 6 weeks	6

A six-week block course 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 haematopathology, immunocytochemistry and immunophenotyping, in addition to the use of radioisotopes in the haematology 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>
CYTOGENETICS AND MOLECULAR TECHNIQUES	MLS-HIST-421	8/Block – 6 weeks	6

This is a six-week block course, which goes beyond the introduction in Module MLS-GENE-126, in semester 2. The students should do by themselves the molecular techniques in cytogenetic, 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>
VIROLOGY TECHNIQUES	MLS- MICR-421	8/Block – 6 weeks	6

A six-week block course 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, hepatitis, 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>
BASIC PARASITOLOGICAL DIAGNOSIS	MLS-PARA-421	8/Block – 6 weeks	6

A six-week block module that reviews the basic and clinical parasitology in Modules MLS-PARA-223 and MLS-PARA-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 CLINICAL CHEMISTRY DIAGNOSIS	MLS-CCHM-422	8/Block -6 weeks	6

This is a six-week block course 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.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
FIELD TRAINING IN CLINICAL HAEMATOLOGY AND BLOOD BANKING	MLS-HAEM-422	8/Block – 6 weeks	6

A six-week block course based on the community or hospital using a logbook and carrying out. Supervised haematological 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 Programs 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 haematology 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 immunohaematology, 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>
BASIC HISTOPATHOLOGICAL DIAGNOSIS	MLS-HIST-422	8/Block – 6 weeks	6

A six-week block course 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-MICRO-422	8 /Block – 6 weeks	6

A six-week block course 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.

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

A six-week block course 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 Programs in the Ministry of Health.

<i>Title</i>	<i>Code</i>	<i>Semester/Duration</i>	<i>Credits</i>
--------------	-------------	--------------------------	----------------

LABORATORY MANAGEMENT AND ECONOMICS	MLS-CCHM-423	8/Block – 2 weeks	2
	MLS-HAEM-423		
	MLS-HIST-423		
	MLS-MICRO-423		
	MLS-PARA-423		

This two-week block course, which 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, and 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-CCHM-424	8/Block – 2 weeks	2
	MLS-HAEM-424		
	MLS-HIST-424		
	MLS-MICR-424		
	MLS-PARA-424		

This is a two-week block course, 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 collected and compiled. It includes also the internet sources of Health information system; 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-RESH-425	8/Longitudinal	6

This is a longitudinal course reserved to writing a short thesis, which can be a review or experimental research. No formal

didactic timetable 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.

