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FACULTY OF SCIENCE AND TECHNOLOGY

**DEPARTMENT OF BIOMEDICAL LABORATORY
SCIENCES**

**CURRICULUM OF BIOMEDICAL
LABORATORY SCIENCES**

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ACRONOMY AND ABBREVIATION

BCG :	Biology-Chemistry-Geography
BLS:	Biomedical laboratory Sciences
BUTH :	Butare Teaching Hospital
CAT:	Continuous assessment tests
CUR:	Catholic University of Rwanda
DNA:	Deoxynucleic Acid
EDPRS:	Economic Development and Poverty Eradication Strategy
FCOM:	Faculty of Commerce
FCRS:	Faculty of catechesis and religious Sciences
FED:	Faculty of Education
FPHHN:	Faculty of Public Health and Human Nutrition
FST:	Faculty of Science and Technology
FSW:	Faculty of Social Work
IFBLS:	International Federation of Biomedical Laboratory Scientists
IT:	Information technology
KFH:	King Faisal Hospital
KMH:	Rwanda Military Hospital
KUTH:	Kigali University Teaching Hospital
MCB :	Mathematics-Chemistry-Biology),
NRL,	National Reference Laboratory
NTL;	National Blood Transfusion Laboratory
PCB,	Physics-Chemistry-Biology
PPE:	Personal Protective Equipment
REB:	Rwanda Education Board
RNA:	Ribonucleic Acid
SWOT:	strengths and weakness, opportunities and threats
UNESCO:	United Nation Education and Cultural Organization
WAN:	Wide Area Network

1.0. Background and Rationale

The Catholic University of Rwanda (CUR) is a private Catholic founded institution of higher learning established by the Catholic Diocese of Butare. The founders of the CUR believe that higher education plays a key role in a sustainable development of a just, equitable and stable society through the training of responsible citizens who are committed and professionally competent and skilled in scientific field. The concept of the CUR was to create a University with a vision and a mission of contributing to the solving of development challenges in Rwanda.

Rwanda government “Vision 2020” clearly stipulates a developmental agenda to become a middle-income country by the year 2020. However, one of the major challenges facing Rwanda is the low level of competent, skilled human resources in the scientific field. In order to overcome these challenges, the country is targeting a knowledge-based economy with skills to further its development in sciences, research, industry, education as well as professional social services provision. The National Skills Audit for the Economic Development and Poverty Eradication Strategy (EDPRS) indicated a gap of 51 (%) in the health sector, 43 percent (%) of which is accounted for by skilled personnel such as nurses, social workers and medical laboratory scientists (National Skills Audit Report, 2009). The CUR intends to provide graduates in biomedical laboratory sciences who are capable of pursuing careers in a wider field of health sector. Through this graduate program the CUR strives to keep in touch with the basic realities of the society in a very close collaboration with the local population so that its accredited programs serve to promote the rural areas in a concrete and practical manner. By so doing, the CUR will contribute to bridging the gaps as mentioned in the national audit Report of 2009, and thus an attempt to contribute to the government of Rwanda’s endeavor to eradicate diseases and poverty in the country.

The Biomedical Laboratory Sciences training is a fundamental tool in the health sector for the clinical laboratory diagnosis and research of various diseases for efficient monitoring and treatment of patients. Based on laboratory data and information provided

by members of the profession, crucial evidence based decisions affecting public health are made. In order to achieve high quality and accurate evidence based decisions by clinicians and other health sector policy makers, the students of the BLS undergoing intensive training in Biomedical Laboratory Sciences (BLS) to acquire competencies and skills that will enable them to provide valid and reliable laboratory information and data/results.

1. 1 National level Accreditation

This CUR curriculum takes into account the recognition of Rwanda Higher Education Council (HEC) framework and standards of education and training. The University was, therefore, provisionally established and accredited in 2010 under the law n°20/2005 of 20/10/2005 that established organization and functioning of higher education in Rwanda. Currently CUR is fully accredited by the Ministerial order No 01/2015 of 06/01/2015. The University (CUR) is located in the Southern Province of Rwanda where it has two campuses; one in the District of Huye (Taba Campus) and another one in the District of Gisagara (Alexis Kagame Save Campus).

1.2 International level accreditation and benchmarking

The International Federation of Biomedical Laboratory Scientists (IFBLS) recommends the bachelor of Biomedical Laboratory Sciences as the preliminary educational qualification for biomedical Laboratory Professionals. The current health requirements in Rwanda are no less than those in developed countries, which necessitate advanced understanding of the biology of diseases. This curriculum therefore addresses the IFBLS educational modules' requirements (IBMS, 2004) for enhanced comprehensive understanding of pathology and clinical laboratory diagnosis principles, competencies and skills.

In countries where certificate programs still exist, the general rule is to establish academic pathways that facilitate practitioner's ability to access academic institutions that

offer programs at Diploma level and a bachelor’s degree level (IFBLS, 1998; IBMS, 2004). Therefore, CUR is striving to be in step with the national level education requirements and international benchmarking by offering a credible degree program that provides skills and competencies to graduates who will meet the Rwanda government aspirations in solving the problems of the population.

1.3 Faculties

The Catholic University of Rwanda comprises of six (06) faculties divided into the following departments:

Faculty	Department
1. Faculty of Catechesis and Religious Sciences (FCRS)	Catechesis Religious Sciences
2. Faculty of Commerce (FCOM)	Management & Accounting Commercial engineering
3. Faculty of Education (FED)	Educational Management and Planning. Didactics (Math-Computer-Education)
4. Faculty of Public Health and Human Nutrition (FPHHN)	Public Health Human Nutrition
5. Faculty of Science and Technology (FST)	Biomedical Laboratory sciences Computer science
6. Faculty of Social Work (FSW)	Child & Family studies Welfare & Social development

1.4 CUR Vision:

CUR vision could be summarized in the following terms: “Excellence for the promotion of science, education of honest and committed professionals for the social, economic, technological transformation and religious training.”

1.5 CUR Mission

- To promote top quality education in various disciplines;
- To instill moral and social values through education of citizens free of all forms of discrimination including gender-based;
- To promote Research, Consultancy and Community service in order to better meet the population fundamental needs

2.0. Program outcomes

The objectives of the Biomedical Laboratory Sciences program are to prepare professionals who are competent to analyze and interpret laboratory investigation results, with competencies to explain to other health-care professionals the appropriate use and meaning of laboratory tests results. Upon completion of the program, the graduate will have acquired the professional knowledge, skills and attitudes, which are necessary to fulfill the job requirements of a biomedical laboratory scientist in a clinical diagnostic laboratory, clinical and biomedical research institutions, as well as laboratory investigations of diseases ‘causes or outbreaks of public health importance. Specifically, the graduates will be able to:

- Apply theory and skills gained in planning and developing a biomedical laboratory infrastructure and set up for efficient laboratory test services flow
- Acquire skills to solve problems, analytical trouble shootings, interpret and correlate the diagnostic results obtained in relation to the clinical information, and use statistical approaches for data management and quality improvements.

- Understand the principles and applications of biomedical laboratory diagnostic instruments
- Apply and observe professional ethics and good laboratory practices in handling of patients and laboratory specimens in order to meet customer/client satisfaction.
- Prepare the graduates for higher education at MSc and PhD levels in biomedical laboratory sciences. Technically and skillfully collect, preserve and transport biological specimens from a variety of sources
- Apply acquired skills and knowledge in biomedical laboratory disciplines for analysis and interpretation of tests results
- Plan and manage laboratory quality activities with the aim to ensure accurate and reliable results
- Apply knowledge, and skills in biomedical laboratory sciences and critical-thinking in the process of analyzing specimens for clinical laboratory diagnosis , research and health problems-solving
- Participate in scientific research applying appropriate and optimized laboratory technology and contribute to upholding health standards in Rwanda and in the region through researches and technology transfer to community services.
- Evaluate and validate new laboratory medicine technologies
- Apply bio-safety and bio-security practices to protect laboratory personnel, laboratory clients, and the environment.
- Develop and implement internal quality control programs and external quality assessment schemes.
- Promote and apply the principles and practices of laboratory accreditation consistent with national, regional and international standards.
- Demonstrate attitudes and ethical behaviors essential to professional practices that promote excellence in the services and healthcare of the population.
- Transfer acquired knowledge and skills to others in biomedical laboratory sciences and related fields.
- Train and supervise clinical attachment students , lower technical staff and scientists in modern laboratory technology

3.0 Entry requirements for admission to the Biomedical Laboratory Sciences Program

Unless otherwise provided for or subject to any other faculty special regulations, the national minimum requirements for admission to the BSc. BLS shall have the Certificate of Secondary Education Examination awarded by the Rwanda Examination Board (REB) or its equivalent with principal passes in at least any two course relevant subjects. A student wishing to join the program of biomedical laboratory sciences should comply with the following conditions:

- Have completed six years of secondary education with the following minimum qualification:
 - Advanced Certificate awarded by the Rwanda Education Board (REB) or its equivalent from a recognized institution with at least two principal passes in any of the following subject combinations:
 - ❖ Physics-Chemistry-Biology (PCB),
 - ❖ Mathematics-Chemistry-Biology (MCB),
 - ❖ Biology-Chemistry-Geography (BCG)
 - Advanced level certificate of education (A2) option in medical laboratory sciences/ technology or its equivalent from a recognized institution
- In addition the student should have computer skills at user level and good command of English language; both spoken and writing.

4.0 Exit award

Successful completion of the program of Biomedical Laboratory Sciences at the CUR will lead to the award of Bachelor of Science with Honors in Biomedical Laboratory Sciences. The studies and examinations for the award of the degree of Bachelor of Science in Biomedical Laboratory Sciences (B.Sc. in BLS) will be governed by the regulations of the Catholic University of Rwanda and those of the Faculty of Science and Technology and the Department of Biomedical Laboratory Sciences.

5. Entry subject requirements

The national and international accreditation of the program requires that the Biomedical laboratory sciences program includes detailed aspects of Biomedical Laboratory Sciences relevant in the core subjects, together with studies in prerequisite foundation subjects, all integrated for a thorough understanding of the pathophysiology of diseases and their clinical laboratory diagnosis.

5.1 Foundation modules

The foundation subjects, which support thorough and comprehensive understanding of the core medical laboratory science disciplines, include the following (8) subjects:

- Behavioral sciences
- Anatomy and physiology
- Cell biology, cytology & genetics
- Biochemistry
- Pharmacology and Toxicology
- Analytical Chemistry and Instrumentation,
- Biostatistics
- Computer and Information Technology skills.

5.2 Biomedical Laboratory Sciences Core Subjects

The core subject areas that constitute the “must know” of the medical laboratory sciences and students graduating from the CUR must have acquired knowledge competencies, diagnostic and research skills in at least the ten (10) core professional disciplines of which the programs includes:

- Medical Microbiology
- Hematology and immunohematology,
- Molecular biology,
- Immunology ,
- Clinical chemistry,

- Phlebotomy and specimen management,
- Histology and Histopathology,
- Medical Virology,
- Medical parasitology and entomology
- Principles and Practices of quality clinical laboratory management.

6.0 Job opportunities

The following professional competencies and skills are inscribed in the various theoretical modules and practical sessions to enable graduates successfully performance their functions in the health and research sector facilities. They include integrating clinical information and clinical laboratory data and interpreting results; description, understanding the principles and use of analytical clinical laboratory techniques; description , understanding the principles and use of laboratory technology equipment; application of biosafety practices; management of quality laboratory procedure and programs to ensure quality results; engaging in research and development; professional ethics and practices, strategic planning for the efficient and effective laboratory output. The graduates shall, therefore, have the job opportunities to work in the following health facilities and establishments:

- Public clinical laboratories in referral, provincial and district hospitals
- Private clinical and polyclinic laboratory centres
- Biomedical and clinical laboratory research centres
- Quality control and quality assurance laboratories
- Pharmaceutical laboratories
- Epidemic and Public health laboratories

- 7.0 Academic staff for the program of Biomedical Laboratory Sciences

The appendix 1 gives the list of lecturers in the department of Medical Laboratory Sciences.

8.0 Physical Facilities

The CUR has developed suitable and adequate infrastructure space for the program as indicated in the tables.

Table 1: Class rooms

S/N0	Room	Dimensions in Meters	Areas (s. qm)	Number of students	Space per student	National standards/	Observations and strategies
01	A1	12.0 x 14.4	168	100	1.68	1m2	Meets national accreditation standards. Strategy is to divide the number of theory classes to 45-50 students per session
02	A2	12.5 x 12.7	158.7	100	1.6	1m2	
03	A3	12.5 x 12.5	156.25	100	1.6	1m2	
04	B1	14.0x 14.0	196	100	2.0	1m2	
05	B2	13.5x 14.0	189	100	1.9	1m2	
06	B3	6.7x 14.0	93.8	100	0.94	1m2	
07	B4	6.7x 14.0	93.8	100	0.94	1m2	
08	B5	6.7x 14.0	93.8	100	0.94	1m2	
09	B6	6.8x 14.0	95.2	100	0.95	1m2	
10	B7	6.8x 14.0	95.2	100	0.95	1m2	
11	B9	6.80x14.0	95.2	100	0.95	1m2	
12	B10	6.7x 14.0	93.8	100	0.94	1m2	
13	B11	6.7 x 14.0	93.8	100	0.94	1m2	

Table 2: Practical Laboratory Rooms

Room NO	Dimensions in meters	Areas (s.qm)	Capacity (NO of students)	Space per student m ²	National standards /	Subject option	Observations and strategies
1	14.0 x 9.0	126.0	30	4.2	2.5 m ²	Chemistry and Clinical Chemistry	Meets accreditation standards. Strategy is to increase the number of practical rooms
2	14.0x 14.0	196.0	30	6.53	2.5 m ²	Microbiology and Parasitology	
3	14.0 x 14.0	196.0	30	6.53	2.5 m ²	Haematology and Immunoserology	

All laboratories are sufficiently equipped with necessary instruments and have adequate space to accommodate the different laboratory practicals that are expected in different medical laboratory science disciplines. Apart from class room practicals the CUR operates in partnership with the clinical laboratories in the hospitals such as Butare Teaching Hospital (BUTH), Kabutare, Kibilizi, Nyanza for clinical laboratory attachments of the students. With regard to physical facilities, the University has sufficient class rooms and a library which is also well stocked with current books for the students' self study and referencing. Two computer laboratories with 68 computers with internet connections serve the students on a 15hrs basis.

9.0. Program duration, structure, mode of delivery, evaluations and awards

9.1 Program duration

The BSc (BLS) programs will be delivered in two modular programs; full-time and part-time students. The full time program shall be attainable in four (4) years, eight (8)

semesters and the program for the part time students will be attained in five and half (5.5) years, eleven (11) semesters.

9.2 Program structure and mode of delivery

The Bachelor of Science BSc. BLS program will run for four (4) years for full time students and five and half (5.5) years for part time student, and the teaching methodologies will involve theory and practical sessions, tutorials, seminars and clinical laboratory attachments and the research project. The research project will be written and submitted for examination at the end of the final year, the 4th year of study. Each module will have a module-leader. The module leader will plan the self-learning experiences and assignments prior to the beginning of the module. Provisions for these learning experiences must appear in each module guideline, a copy of which shall be issued to the students at the commencement of each module.

9.3 Modules Credit Weighting

9.3.1 Module Types

The Modules offered in this program include specific types as indicated below, which will be conducted and coordinated by the CUR and partners at clinical laboratory attachment centres:

1. Modules conducted at CUR Campus:

The normal theory lectures and practical sessions, seminars and tutorials, which will be conducted at CUR campus

2. Clinical laboratory attachment modules:

The hands-on practical skills training, will be done at different hospital laboratories, biomedical/medical research facilities, including: Kigali University Teaching Hospital (KUTH), Rwanda Military Hospital (KMH), King Faisal Hospital (KFH), National Reference Laboratory (NRL), Butare University

Teaching Hospital (BUTH), National Blood Transfusion Laboratory (NTL); District hospital Laboratories such as Kibilizi, Kabutare, Nyanza, Kabgayi , etc.

3. **Special Research Project module:**

Students who are enrolled in the program will be required to carry out a Biomedical Research Project in the final year. The research project report forms part of the program modules in order to successfully complete the degree program.

9. 3. 2 Module credits and coding

1. A credit unit is granted for a series of ten contact hours in form of:
 - One lecture hour
 - One practical hour
2. With regard to clinical laboratory attachment, one week (01week) is equals to four (04) credit units
3. The research project is equal to twenty (20) credit units
4. Concerning module coding the following are keys:
 - Each module is composed of three letters reflecting its naming; for example, Behavioural Sciences has been coded as BSC
 - Each module is composed of four digits:
 - ❖ The first digit reflects the level of study
 - ❖ The second digit reflects the Faculty
 - ❖ The third digit reflects the semester
 - ❖ The fourth digit reflects the number of credits (5credits = 1 , 10 credits = 2 , 15 credits =3 , 20 credits =4, 30 credits = 5 ,40 credits = 6)
 - Thus, Behavioural Sciences is coded as BSC1513

9. 4 Evaluations

Documented methods of evaluation must be provided to the students at the time of entry into the program. Written criteria for passing, failing, and progression in the program must also be provided at the same time. Evaluation systems must be related to the objectives, competencies and skills outcomes as described in the curriculum for both didactic and applied components. Evaluations must be employed frequently enough to provide students and faculty with timely indications of the students' academic standing and progress and to serve as a reliable indicator of the effectiveness of the methods of instruction and course design.

9. 5 Degree Awards

The degree awards will be credit-based and in line with the regulations and guidelines as defined in Rwanda Education Qualification Framework for Higher Education Institutions. The program of Biomedical Laboratory Sciences at the CUR will offer Bachelor of Science Degree with Honors in Biomedical Laboratory Sciences (BSc. BLS to candidates who successfully complete the prescribed program.

10. Summary of Program hours and credits

Year	Theoretical (Hours)	Practical (Hours)	Clinical laboratory Placement (Hours)	Research Project	Total hours/credits
1	890	310	-	-	1200/120
2	620	330	300	-	1250 /125
3	590	410	400	-	1400/140
4	350	350	300	200	1200/120
TOTAL	2450	1400	1000	200	5050/505

11.0 Modules and credit hours per level/ year of study

Level 1 (1st semester)

Course Code	Module series	Module course	Subject Units	Lecture Hours	Practical Hours	Total Hours	Credits
BSC 1512	1	1.Behavioral Sciences	1.Psychology & Counseling,	50	0	50	5
			2.Communication skills and professional ethics	50	0	50	5
			3.Social church doctrine				
ITC 1511	2	Information Technology and Computer Skills	Introduction to computers skills and application	20	30	50	5
PHE 1512	3	Public Health and Epidemiology	Public health	50	0	50	5
			Epidemiology	50		50	5
BCG 1513	4	Biochemistry & Cell Biology and Genetics	General Biochemistry	70	30	100	10
			Cell biology & Genetics	50	0	50	5
HAP 1513	5	Human Anatomy& Physiology	Human Anatomy	40	10	50	5
			Human Physiology	80	20	100	10
PSM 1512	6	Phlebotomy and Specimens Management	1.Phlebotomy 2.Specimens Management	60	40	100	10

Level 1 (2nd semester)

Code	Module series	Module course	Subject Units	Lecture Hours	Practical Hours	Total Hours	Credits
PHT 1522	7	Pharmacology and Toxicology	Pharmacology	50	0	50	5
			Toxicology	50	0	50	5
MPE 1522	8	Medical Parasitology I & Entomology	Medical Parasitology I	30	20	50	5
			Entomology	50	0	50	5
GMI 1522	9	General Microbiology	General Microbiology	70	30	100	10
HEM 1522	10	Hematology I	Hematology I	50	50	100	10
ACI 1522	11	Analytical Chemistry and Instrumentation	-Analytical Chemistry -Instrumentation (no body)	50	50	100	10
CCH 1522	12	Clinical Chemistry I	Clinical Chemistry I	50	50	100	10
		Total		920	330	1250	125

Level 2 (1st semester)

Code	Module series	Module Course	Subject Units	Lecture hours	Practical hours	Total hours	Credits
BIO 2512	13	Biostatistics	Biostatistics	50	50	100	10
ENT 2512	14	Entrepreneurship	Entrepreneurship	60	40	100	10
HIM 2512	15	Hematology II & Immuno-hematology I	Hematology II	70	30	100	10
			Immuno-hematology I	50	0	50	5
HCY 2512	16	Histotology & Cytopathology	Histotology & Cytopathology	60	40	100	10
CCH 2512	17	Clinical Chemistry II	Clinical Chemistry II	60	40	100	10

Level 2 (2nd semester)

Cod e	Modul e series	Module course	Subject Units	Lectu re Hrs	Practic al Hrs	Total Hrs	Credit s
MM I 2522	18	Bacteriology I	Bacteriology I	50	50	100	10
MP A25 21	19	Medical Parasitology II	Medical Parasitology II	30	20	50	5
IMV 2523	20	Immunology I and Virology	Immunology I	50	25	75	7.5
			Virology	50	25	75	7.5
PQL 2522	21	Clinical Laboratory Management	Clinical Laboratory Management(fat)	70	30	100	10

CLA 2525	22	Clinical Laboratory Attachment I	Clinical laboratory Attachment I	0	300	300	30
		Total		620	630	1250	125

Level 3 (1st Semester)

Code	Module series	Module Course	Subject Units	Lecture hrs	Practical hrs	Total hrs	Credits
CCH 3512	23	Clinical Chemistry III	Clinical Chemistry III	50	50	100	10
MMI 3514	24	Medical Microbiology II	Food and water Microbiology	50	50	100	10
			Mycology (fatuma)	50	50	100	10
MBI 3512	25	Molecular Biology I	Molecular Biology I (no body)	80	20	100	10
CLA 3516	26	Clinical Laboratory Attachment	Clinical Laboratory Attachment II	0	400	400	40
						800	80

Level 4 (2nd semester)

Code	Module Series	Module Course	Subject Units	Lecture Hours	Practical Hours	Total Hours	Credits
MPA 4522	27	Medical Parasitology III	1.Medical Parasitology III	50	50	100	10
HIH 4523	28	Histotechnology & Histopathology	Histotechnology &Histopathology	70	80	150	15
REM 4522	29	Research Methodology	Research Methodology	70	30	100	10
IMM 4522	30	Immunology II	Immunology II	60	40	100	10
HIM 4523	31	Hematology III and Immunohematology II	1.Hematology III (no body)	30	20	50	5
			2.Immuno-hematology II	70	30	100	10
		Total		590	810	1400	140

11.4 Level 5 (1st semester)

Code	Module series	Module course	Subject Units	Lecture Hours	Practical Hours	Total Hours	Credits
MBI 5512	32	Molecular Biology II	Molecular Biology II	60	40	100	10
MMI 5512	33	Medical Microbiology III	Microbiology IV	50	50	100	10
IPP 5512	34	Integrated Pathophysiology	-Medical Semiology -Integrated Pathophysiology	50	50	100	10
HIM 5513	35	Hematology IV & Immunohematology III	Hematology IV	60	40	100	10
			Immunohematology III	30	20	50	5
CCH 5512	36	Clinical Chemistry IV	Clinical Chemistry IV	50	50	100	10
MPA 5513	37	Medical Parasitology IV	Medical Parasitology IV	50	100	150	15

Level 5/Year 4 (2nd semester)

Code	Module series	Module Course	Subject Units	Lecture Hours	Practical Hours	Total Hours	Credits
RPR 5524	38	Research Project	Research Project	0	200	200	20
CLA 5525	39	Clinical Laboratory Attachments III	1.Clinical Laboratory Attachment III	0	300	300	30
		Total		350	850	1200	120

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12.0 Module name course outlines and content

Year 1/Level1: Semester 1.

Module 1: Behavioural Sciences

12.1 Behavioural Sciences

Module Code:	Module N0	Course name	Subject Units:	Credits:
BSC 1512	1	Behavioral Sciences	1. Psychology and Counseling	5
			2. Communication skills and Professional ethics 3. Social Church doctrine	5

1. **Pre-requisite or requisite modules:** None
2. **Administering Faculty:** FST
3. **Allocation of study and teaching hours**

Module outline	Student hours	Lecturer hours
Lectures/Face to Face	36	36
Seminars/workshops	5	5
Practical classes/laboratory		
Structured exercises	10	10
Set reading		
Self-directed study	29	29
Assignments-preparation and writing	10	10

5. Aims of the module

The module aims at equipping the students with the knowledge and principles psychology and counseling, effective communication skills and professional ethics which they will apply in executing their clinical laboratory services. The module will also enlighten the students on the principles and code of conduct and social behavior according to social church doctrine.

- Introduce to the students to the concepts and principles influencing health and human behavior
- Explain the roles of biological, environmental, social and psychological factors on health and illness
- Explain the psychosocial factors affecting health and illness within every day clinical practice.
- Introduce to the students the concepts and principles of counseling and communication skills
- Explain the different means of communication and factors affecting effective communication
- Explain the applications of effective communication in health care environment
- Communicate effectively in order to cause positive behaviour change among individuals, groups, & community.
- Introduce the health ethics; the roles and applications in health care delivery and laboratory medicine,

4. Learning Outcomes

- **Knowledge**

At the end of the module, students will be able to:

- Explain the psychological, social and environmental factors influencing health
- Discuss applications of psychology and sociology, in relation to health and care promotion

- Describe the counseling process and identify the types of situations where counseling is needed
- Explain the principles of communication
- Describe different methods of communication
- Explain different factors affecting effective communication
- Demonstrate appropriate and effective communication skills across settings, purposes, and audiences.
- Demonstrate knowledge of communication theory and application.
- Practice critical thinking to develop innovative and well-founded perspectives related to the students' emphases.
- Build and maintain healthy and effective relationships.
- Use technology to communicate effectively in various settings and contexts.
- Demonstrate appropriate and professional ethical behavior
- Explain the process of communication and the basic elements in communication
- Describe Communication skills and the importance of effective communication
- Compare the types and methods of communication
- Explain the stages of communication
- Discuss the barriers of communication and ways to overcome them
- Describe group dynamics
- Prepare and deliver effective audio-visual presentations
- Provide effective counseling to clients
- Demonstrate ability to teach clients
- Appreciate the role and value of health care information and its impact on outcome
- Appreciate the relevance of listening, verbal and nonverbal communication
- The theoretical, historical and practical dimension of the social teaching of the church
- The methodology of the social teaching of the church

- **Competences and Skills**

At the end of the module, students will be able to:

- Identify clients who need counseling services and impart effective counseling to the clients
- Effectively apply communication skills
- Use current technologies to effectively communicate health related information
- Effectively apply ethical behavior in health care delivery and quality laboratory services
- Elaborate some themes of the social doctrine of the church in relation to social some situation
- Apply the principles for reflection, the criteria for judgment and guidelines for action to social problems
- Exhibit professional behaviors

Attitudes

At the end of the module, students will be able to:

- Demonstrate attitudes and abilities to develop a cordial relationship with clinical laboratory clients
- Adopt appropriate language and communication in managing and handling patients and clients
- Demonstrate good professional conduct
- Apply in the dairy life some social church doctrines

7. Indicative content

Psychology:

- Background of psychology (Theorists, main Theory, Research Methods in psychology)
- Introduction to Health psychology and the bio-psychosocial model of health
- Stress and health
- Psychological effects of illness, the psychology of pain and pain management
- Loss and grief
- Psychosomatic disorder
- Relationship between care givers and client and family
- The role of psychology in health promotion and illness prevention
- Behavior change

Counseling:

- Definition of counseling
- Importance and goals of Counseling
- Principles of counseling
- Counseling process
- Types of situations necessary for counseling
- Qualities of an effective counselor
- Skills of counseling
- Various approaches of counseling

Communication:

- **Knowledge**
- Communication skills
- Definition of communication, Health professionals, communication network
- Communication process
- Methods of communication
- Stages of communication

- Barriers of communication and overcoming them
- Basic communication skills
- Forms and types of communication,
- Qualities and advantages of effective communication
- Preparing and Delivering effective audio visual presentations
- Group dynamics
- Terminologies in communication :(IEC, BCC, SBC) Information, Education, communication; Behaviour Change Communication; Strategic Behaviour Change
- **Skills**
- Demonstrate critical and innovative thinking.
- Display competence in oral, written, and visual communication.
- Apply communication theories.
- Use current technology related to the communication field.
- Respond effectively to cultural communication differences.
- D Demonstrate use of communication skills with individuals, families and community
- Use current technology for effective communication of health related information
- Demonstrate positive group communication exchanges.

Professional ethics

- Laboratory Ethics
- Good laboratory practices
- Professional behaviours
- Code of Conduct

Social church doctrine

- Nature and history of the social doctrine of the church
- The dignity of the human person

- The human person and the society
- The principle of the common good, solidarity, subsidiarity and participation
- The universal destination of the goods

8. Learning and teaching strategy

- These will include lectures, self-directed learning, discussions and student presentations, group discussions of case studies, demonstrations and practical exercises, role play demonstrations with simulated patients (SP simulation), audio-visual and Power point presentations

- **9. Assessment strategy**

- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation =60 %; End of module assessment Exam = 40 %

10. Assessment

pattern

Component	Weight (%)
In- course assessment	20
CATs	40
Final assessment	40

11. Strategy for feedback and students support during module

- A variety of teaching and learning strategies will be adopted in this module including lectures, self-directed learning, discussions and student presentations, group work, case studies, demonstrations and practical exercise, role play, demonstrations with simulated patients (SP simulation), audio-visual
- Oral feedback will be given in class during the teaching-learning process.
- Questions will be answered as they are raised.
- Comments and corrections on assignment copies will be given to students.

12. Teaching /Technical Tools

- Simulated patients (SP simulation)
- Audio-visual material
- Projector
- Flipcharts and markers
- White board and markers

13. Indicative resources:

Core texts & recommended reading

1. Neereja Kp (2003) *textbook of sociology for nursing student*, Jaypee brothers, medical publisher, new delhi.
2. Sadock, B.J. & Sadock, V.A. (2003) *Kaplan and Sadock's synopsis of psychiatry: Behavioral Sciences / Clinical Psychiatry 10th edition*. Philadelphia: Lippincott Williams & Wilkins. ISBN: 0-7817-3183-6
3. Brousseau E., Paquet M., Poitras S., Riopel O. (2003) Cours de Sociologie générale http://www.socio.umontreal.ca/files/SOL1100_2003.pdf.
4. Gladding S.T. (1988) *Counseling. A comprehensive Profession* (Columbus OH. Marri/ Publishing
5. Dickson, D., (1997). *Communication skills training for Health workers*, Lincott publishers
6. Dickson, D., (1997). *Communication skills training for Health workers*, Lincott publishers
7. Hubley, J., (1995). *Communicating Health: an action guide to health education and health promotion*, Macmillan education ltd.
8. Kenya Medical Training Centre (2006). *Communication skills: A procedure manual*
9. Glendinning Eric H.(2005): *English in Medecine, a Course in Communication Skills*, CUP, London, UK

10. Anita Reetz; Jim McGiffert (2008): *English for Medical Professionals*, KHI, Kigali, Rwanda
11. Recommended Reading (illustrative):
12. Berry, D. (2004). *Risk, communication and health*. Maidenhead, UK: Open University Press.

Essential reading text books:

13. Ogden, J. (2007). *Health psychology (4th ed)*. Buckingham, UK: Open University Press.
14. Cox, T. (1985). *Stress*. London: McMillan.
15. Crossley, M. (2000). *Rethinking health psychology*. Buckingham, UK: Open University Press.
16. Marks, D.F. (2002). *The health psychology reader*. London: Sage.
17. Marks, D.F., Murray, M., Evans, B. & Willig, C. (2005). *Health psychology (2nd Ed): Theory, research and practice*. London: Sage.
18. Rutter, D., & Quine, L. (2002). *Changing health behaviour*. Buckingham, UK: Open University Press
19. Fernald, L.; Fernald, P.S. (1999) *introduction to psychology. Fifth edition. Delhi: A.I.T.B.S.educational Books*.
20. Kirby, M. ; Kidd W. ; Koubel, F.; Barter, J.; Hope T. ; Kirton A. ; Madry, N. et al (1997) *Sociology in perspective*. Oxford: Heinemann
21. Kidd, W.; Kirby, M.; Koubel, F.; Barter, J.; Kirton A. ; Madry, N.; Manning P. et al (1998) *Readings in sociology*. Oxford: Heinemann.
22. Cleary, A. & Treacy, M. P. (eds) (1997) *The Sociology of Health and Illness in Ireland*. Dublin: University College Dublin Press.
23. Giddens, A. (2006) *Sociology 5th ed*. Cambridge: Polity.
24. Hyde, A., Lohan, M., McDonnell, O. (2004) *Sociology for Health Professionals in Ireland*. Dublin: Institute of Public Administration.
25. Share, P. Tovey H & Corcoran P. *Sociology of Ireland Third Edition*. Dublin: Gill & Macmillan Ltd *Compendium of the Social Doctrine of the Church*

26. Hundred years of the social teaching of the Church
27. Rerum Novarum (The Condition of Labour)
28. Populorum Progressio (The Development of the People)
29. Laborem Exercens (On Human Work)

Electronic references

1. Blackwell Synergy Online Journals for learning, research and professional practice
2. <http://www.blackwell-synergy.com/>
3. Social Science Information Gateway (SOSIG):
<http://www.intute.ac.uk/socialsciences/education/> <http://www.altavista.com/>
4. Allyn & Bacon sociology links <http://www.abacon.com/sociology/soclinks/>
5. Annual reviews sociology <http://soc.annualreviews.org/>

Module 2: Information Technology and Computer Skills

12.2 Information Technology and Computer Skills

Module Code:	Module N ^o	Course name	Subject Units:	Credits:
ITC 1511	2	Information Technology and Computer Skills	Introduction to computers skills and application	5

1. **Pre-requisite or requisite modules:** None
2. **Administering Faculty:** FST
3. **Allocation of study and teaching hours**

Module outline	Student hours	Lecturer hours
Lectures	18	18
Seminars/workshops		
Practical classes/laboratory	17	17
Structured exercises		
Set reading	-	-
Self-directed study	5	5
Assignments-preparation and writing	5	5
Examination	5	5
Total	50	50

4. Aims of the module

- This course is designed to introduce students to skills in selected computer systems and programs and Information Communication Technology.

5. Learning Outcomes

Knowledge

- By the end of this course the students should be able to perform the following:
- To demonstrate how computer technologies can be applied to store and manage information
- To demonstrate computer applications with relevance to scientific training and data management
- To Describe and identify the different parts of a computer
- Explain the functions of different components of the computer and their uses;
- Explain the terms hardware, software, Information Technology (IT), local area network (LAN), Wide Area Network (WAN), web page, Search Engine, Electronic mail;
- Distinguish between operating systems software and applications software;
- Describe the basic concepts in ICT and client/server system
- Demonstrate ability to make use of different parts of the computer.
- Ability to communicate using IT and appreciate the importance of IT in learning and daily activities
- File Access, Operate MS Office (Word processing, Spreadsheet, Presentation and Basic Database) competently, Demonstrate understanding of how to use internet web browsers to search for information
- Demonstrate ability to browse and access relevant information on internet
- Use and demonstrate ability to use CUR Learning Management System
- Upload and download objects, files, and files on CR Moodle
- Understanding how to use internet to search for information ,demonstrate ability to browse and access relevant information on internet
- Use learning management systems, Protect the privacy, confidentiality, and security of health information
- Understand importance of database and confidential information, promote the development of health technical skills, attitudes and values necessary for learning

6. -Indicative content

- **Computer concept , Principle and parts**

What is Computer, Basic Applications of Computer; Components of Computer System, Central Processing Unit (CPU), VDU, Keyboard and Mouse, Other input/output Devices, Computer Memory, Concepts of Hardware and Software; Concept of Computing, Data and Information; Applications of IECT; Connecting keyboard, mouse, monitor and printer to CPU and checking power supply.

- **Operating Computer using GUI Based Operating System:**

What is an Operating System; Basics of Popular Operating Systems; The User Interface, Using Mouse; Using right Button of the Mouse and Moving Icons on the screen, Use of Common Icons, Status Bar, Using Menu and Menu-selection, Running an Application, Viewing of File, Folders and Directories, Creating and Renaming of files and folders, Opening and closing of different Windows; using help; Creating Short cuts, Basics of O.S Setup; Common utilities.

- **Word Processor: Word Processing Basics**

Opening and Closing of documents; Text creation and Manipulation; Formatting of text; Table handling; Spell check, language setting and thesaurus; Printing of word document.

- **The Spread Sheet**

- **The Basics of Spreadsheet; Manipulation of cells; Formula and Functions; Editing of Spread Sheet, printing of Spread Sheet.**

- **The Internet:** Basic of Computer networks; LAN, WAN; Concept of Internet; Applications of Internet; connecting to internet; What is ISP; Knowing the Internet;

Basics of internet connectivity related troubleshooting; Web Browsing software, Search Engines; Understanding URL; Domain name; IP Address; Using e-governance website.

- **Communications and collaboration:**

Basics of electronic mail; Getting an email account; Sending and receiving emails; Accessing sent emails; Using Emails; Document collaboration; Instant Messaging; Netiquettes.

- **Power point Presentation:**

Basics of presentation software; Preparation and Presentation of Slides; Slide Show; Taking printouts of presentation /handouts.

- **Learning CUR Management System (Moodle):**

Introduction to Learning management system, Moodle; Authentication and login access, Enrolment; Assignments and quiz; Participation in forum and Chat; Feedback and Grades

8. Learning and teaching strategy

- Lectures
- Practicals
- Assignment
- Seminars
- Group Discussion

9. Assessment strategy

- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation =60 %; End of module assessment Exam = 40 %

10. Assessment pattern

Component	Weight (%)
In course assignment	20
CATs	40
Final assessment	40

11. Strategy for feedback and students support during the module

- Students will be encouraged to use computers throughout their study in order to learn and develop skills. Oral feedback will be given in class during the teaching-learning process.
- Feedback on assignments will be discussed in groups and in class

12. Teaching /Technical Tools

The following will be available for students:

- Computer laboratories open from
- Wireless connection
- The internet bandwidth is enough to serve the whole community
- Personal laptops are allowed to be used in class and exam
- Projector

13. Indicative resource materials:

1. Absolute Beginners Guide to Computer Basics (5th Edition), Michael Miller (Sep 11, 2009)
2. Computer Basics Absolute Beginner's Guide, Windows 8 Edition (6th Edition), Michael Miller (Sep 26, 2012)
3. Office 2013 All-In-One For Dummies, Peter Weverka (Mar 4, 2013)

4. Microsoft Office 2010 Plain & Simple, Katherine Murray
5. Office 2010: The Missing Manual, Nancy Conner and Matthew MacDonald (Jul 23, 2010)
6. Computer Security Basics, Rick Lehtinen and G.T. Gangemi Sr. (Jun 20, 2006)
7. Computer Security, Dieter Gollmann (Feb 28, 2011)
8. Internet Privacy For Dummies, John R. Levine, Ray Everett-Church, Greg Stebben and David Lawrence (Aug 1, 2002)
9. Complete Guide to Internet Privacy, Anonymity & Security, Matthew Bailey (Jul 30, 2011)
10. Operating System Concepts, Abraham Silberschatz, Peter B. Galvin and Greg Gagne (Jul 29, 2008)
11. Operating Systems, Rohit Khurana (Apr 1, 2011)
12. Office 2010 Bible, John Walkenbach, Herb Tyson, Michael R. Groh, Faithe Wempen, Lisa A. Bucki

Module 3: Public Health and Epidemiology

12.3 Public Health and Epidemiology

Module Code:	Module N0	Course name	Subject Units:	Credits:
PHE 1512	3	Public Health and Epidemiology	1.Public Health 2.Epidemiology	10

1. **Pre-requisite or requisite modules:** None
2. **Administering Faculty:** FPHHN
3. **Allocation of study and teaching hours**

Module outline	Student hours	Lecturer hours
Lectures/Face to Face	36	36
Seminars/workshops	5	5
Practical classes/laboratory		
Structured exercises	10	10
Set reading		
Self-directed study	29	29
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	100	100

4. Aims of the module

- The aims of this module is to introduce the students to the principles and understanding of the role of the medical laboratory scientist in preventing diseases and managing epidemic out breaks , promotion of health environment and protecting and improving the health of communities in which we live.

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

- Describe and explain the basic concepts of epidemiology and public health
- Epidemiological processes and intervention in epidemic diseases out breaks
- Utilize epidemiology data in public health for the broad research strategies disease control
- Apply epidemiological and public health information for improving on community health and forecasting of likely out breaks and planning contingency strategies

5. Learning Outcomes

- Illustrate the interdisciplinary, cross-cutting, or ecological character of public health and the contributions of a range of disciplines and professions to improving health.
- Explain the basic principles of epidemiology, including rates, risk factors, disease determinants, causation, and public health surveillance.
- Explain basic statistical and epidemiologic concepts of estimation, inference, and adjustment to establish association.
- Explain how to use evidence of an association to make a judgment about whether an association is causal using the principles of contributory cause.
- Describe the basic epidemiologic study designs that are used to test hypotheses, identify associations, and establish causation.

- Describe the concepts of measurement of test performance and be able to apply the concepts of testing and screening in different settings.
- Apply the concepts of benefits, harms, and cost to a public health decision.
- Describe the broad applicability of epidemiologic methods to clinical and basic science as well as public policy.
- Explain how public health assesses the options for intervention to improve the health of a population.
- Explain how public health can utilize social and behavioral interventions, health information and health communications to improve the health of populations.
- Explain how public health can utilize health policy and law to improve the health of populations.
- Explain the impact of the environment and communicable diseases on the health of populations.
- Explain the burden of chronic diseases on morbidity and mortality and approaches to prevention, early detection, and disease management.
- Describe the basic organization of health care and public health systems and the contributions of health professionals.
- Identify the basic payment mechanisms for providing health services and the basic insurance mechanisms for paying for health services.
- Identify the roles of public health in addressing the needs of vulnerable populations and health disparities.
- Identify the roles of public health in disaster prevention and management.
- Apply the public health approach to problem solving; causes and effects, intervention and implementation to deal with new public health problem.

Knowledge application

- Apply principles of health communications and informatics to evaluate the quality of health information on the Internet and in the mass media.
- Analyze the advantages and disadvantages of potential interventions. Analyze the evidence for and against a recommendation for intervention.

- Analyze a public health problem (e.g., investigation of a disease outbreak).
- Synthesize epidemiological methods to assess the strengths and weaknesses of assertions in the scientific literature and popular press.
- Evaluate the design of an epidemiologic investigation, demonstrating the ability to reconcile scientific validity and ethical sensitivity.
- Apply principles for evaluating the quality of an existing health delivery system to that of a different health delivery system.
- Analyze the determinants of morbidity and mortality in a new situation.
- Analyze the degree of success in implementing essential public health services in a new situation.
- Synthesize the principles and tools of public health as applied to a new public health problem.

7Indicative content

- Public health overview and basic principles
- Context and scope of public health, including history, philosophy, literature, essential services, ethics, and applications to current events—Public health placed in historical and modern perspective.
- Epidemiologic principles and population perspective —health status indicators of morbidity and mortality.
 - Population health tools, policy, law, and ethics, health communication and informatics, health and social and behavioral science
- Morbidity and mortality: determinants, burdens, and interventions —
- .

Communicable diseases Non-communicable diseases, prevention, detection, and control from a population perspective. Environmental health and injury—Current and potential impacts on of health status

Health-care and public health systems; Organization of health care and public health systems—Institutions and structures of health care and public health systems, both national and international; the distinct roles and complementary responsibilities of health care and public health systems

- Special public health education focus areas; Health disparities and vulnerable populations—Overview of public health’s commitment to vulnerable populations, including maternal and child care, aging, persons with disabilities, and socioeconomically disadvantaged populations.

Epidemiology: History, Philosophy, and Uses of Epidemiology

- Historical contributions and modern uses of epidemiology—Development of epidemiologic thinking and placement of epidemiology in historical and modern perspective. Ethics and philosophy of epidemiology—.

Descriptive Epidemiology: condition, frequency, and severity—the basic tools of epidemiologic analysis, including case definitions and populations, incidence, prevalence, and case-fatality rates. Using data to describe disease and injuries—Vital statistics, public health surveillance, and measures of health status, including methods for describing quantitatively the natural/clinical history

- Association and causation; estimation—measures of the strength of association, graphical display of data, and measures of risk, relative risk, attributable risk, and population impact. Inference—Concepts of statistical significance and confidence intervals. Bias, confounding, and adjustment—causation—Principles of contributory cause based upon evidence of association, the “cause” precedes the “effect” and “altering the “cause” alters the “effect.”
- **Analytic epidemiology:** epidemiologic study designs and their applications to population health including: ecologic or population comparison, cross-sectional, case-control, and retrospective and prospective cohort. **Evidence-Based Public Health;** arm, benefit, and cost analyses—Evidence-based recommendations regarding

benefits, harms, and cost-effectiveness of interventions. Intervention effectiveness—
Evidence-based evaluation of degree of success of interventions.

- **Applications to Policy and Basic and Clinical Sciences;** Outbreak investigation, testing, and screening—application of epidemiologic methods to basic and clinical sciences.

8. Learning and teaching strategy

Teaching methods

- Lecture
- Group discussion
- Case studies
- Demonstration with SPs (Health education and VCT)
- Audio-visual
- Assignments
- Role-play

9. Assessment strategy

- Class presentations, Assignments, MCQs, Case studies, Essays, exams
- Continuous assessment tests (CAT): Assignments, progress tests, student presentation = 60 %; End of module assessment Exam = 40 %

10. Assessment pattern

Component	Weight (%)
Assignments	20
CAT tests	40
Final assessment	40

11. Strategy for feedback and students support during module

- Open hours for student's consultations; individually or in group
- Feedback discussions on assignments and tests

12. Teaching /Technical Tools

- Lectures, class presentations, role play
- Presentations

13. Indicative resource and recommended reading materials:

- **Core text**

1. Epidemiology in public health practice (2010) *edited by:* Annemien Haveman-Nies, Sofieke Jansen, Hans van Oers and Pieter van't Veer, ISBN: 978-90-8686-140-8
2. James F McKenzie, Robert R, Pinger, Jerome E, Kotecki .2013. *An introduction to community health. 7ed* : Jones and Bartlet Learning.
3. Jeff Conant and Pam Fadem . 2008. *A community guide to environmental health: Hesperians health guides*
4. Reuben Granich and Jonathan Merimin. 2006. *HIV, health and your community. A guide for action.* Hesperians health guides

Electronic references

1. Primary health Care Now more than Ever-World Health Report 2008 available at www.who.int/whr/2008/whr08_en.pdf
2. Promoting Health: The Primary Health Care Approach Lyn Talbot, Glenda Verrinder Elsevier Australia, Nov 19, 2009 available as e-book at http://books.google.rw/books/about/Promoting_Health.html?id=n769cCpPZLsC&redir_esc=y

3. Lecture Notes on HIV/AIDS and other human Pathogens available at <http://www.africaw.com/forum/f2/lecture-notes-on-hiv-aids-and-other-human-t1125/>
4. Communicable diseases chapter 6 found at http://www.dft.gov.uk/mca/mcga-shs_capt_guide_chap6.pdf
5. WHO. "Health topics". Primary health care. WHO.
6. http://www.who.int/topics/primary_health_care/en/ Retrieved 28 March 2011.

12.4 Biochemistry, Cell Biology & Genetics

Module Code:	Module N0	Course name	Subject Units	Credits:
BCG 1513	4	Biochemistry, Cell Biology & Genetics	1.Biochemistry,	10
			2.Cell Biology and Genetics	5

1. **Pre-requisite or requisite modules:** None
2. **Administering Faculty:** FST
3. **Allocation of study and teaching hours**

Module outline	Student hours	Lecture hours
Lectures	54	54
Structured exercises	16	16
Set reading		
Self-directed study	50	50
Assignments-preparation and writing	20	20
Examinations-revision and attendance	10	10
Total	150	150

4. Aims of the module:

- This module aims at providing the students with knowledge and understanding the biochemistry of the human body so that they will be able to understand application of clinical chemistry in laboratory medicine.
- The course will provide a deep knowledge and understanding of biomolecules structures and functions, cellular reactions and metabolic pathways, maintenance and expression of genetic information and transfer.
- To develop a deep understanding of principles and processes and information in biological systems, macromolecular structures, enzyme catalysis, proteins function, membrane structure and function, bioenergetics and selected metabolic processes.

5. Learning outcomes

Knowledge:

At the end of this module the student should be able to:

- Review of cell biology, structure and functions at molecular level
- Explain the chemical principles and processes of metabolism.
- Describe the composition and structure of the cell
- Explain types of cell division and life cycle and their role in human body
- Explain the functions of the cell membrane and organelles
- Outline the key features of biological membranes
- Identify different types of the cells and their specific functions
- Describe the structures of biological macromolecules, their components and function; carbohydrates, proteins, lipids, hormones, enzymes.
- Describe the relationship between structure and functions for proteins

- Describe the key metabolic processes within a cell and recognize the importance of regulation of metabolic reactions.
- Discuss the principles and mechanisms of information transfer from DNA to proteins.
- Combine facts and ideas in clear and concise written and oral communications.
- Analyze experimental results using core data-handling skills.
- Detail the role of cell communication in processes such as apoptosis, necrosis
- Demonstrate basic biochemical laboratory skills using safe laboratory practice.

Expected Skills:

- Laboratory Identification of the biochemical compounds of the human body
- Demonstrate the role of the biomolecules in the functioning of the human body
- Microscopic identification of cellular structures
- Application of knowledge of cell biology and genetics to the functioning of human body
- application of knowledge of the gene and chromosomal mutations to the functioning and malfunctioning of the human body

Attitude:

- Appreciate the physiological importance of the biochemical compounds in the functioning of human body.
- Demonstrate good professional conduct
- Follow safety rules and procedures
- Follow directions of the instructor

6. -Indicative contents:

Biochemistry Unit:

The unit will be delivered through a series of lectures and practical sessions which will cover:

- Introduction to amino acids, peptide bonds and protein structure. Diversity of protein function. .
- . Eukaryotic transcription and splicing. The genetic code of proteins
- Protein functions. Enzyme and catalysis function:. Oxygen binding proteins: myoglobin and haemoglobin. Protein action *in vitro* and *in vivo*.
- . Fatty acids, triacylglycerols and phospholipids. Proteins and lipids in membranes; membrane function and structure.
- Introduction to mammalian metabolism. Outline of bioenergetics, the chemical principles behind organic molecules, molecular forces, catalysis and biomolecular structure
- ATP generation and importance.
- Carbohydrate, lipids, proteins and their metabolism. Anabolic and catabolic processes; lipid storage, glycogen synthesis, gluconeogenesis.
- The citric acid cycle. Oxidative phosphorylation.

Cell Biology Unit:

- General structure of cells and tissues: Cell diversity and classification, epithelial, Muscular, Connective, Nervous
- Ultra-structure and organization of cell organelles.
- Cellular compartments; cyto-skeleton and cell motility; types of cell division; relationship between cells, tissues and organs; cellular communication.
- The application of microscopy in cellular biology

Genetics unit

- Basic genetic principles and mechanisms; Mendelian inheritance; Sex determination
- Multiple genes and alleles; Gene expression and genetic disorders; Gene regulation of functions;
- Gene and Chromosomal mutation; Introduction to gene basic unit and structure: ., Chromosomes.

7. Learning and teaching strategy

- Learning and teaching strategy will include lectures, self-directed learning, discussions and student presentations, group discussions, demonstrations and practical exercises, and Power point presentations

8. Assessment strategy

Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation = 60 %; End of module assessment Examination = 40 %

9. Assessment pattern

Component	Weight (%)
In- course assessment	20
CAT Test	40
Final assessment	40

11. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions will be answered as they are raised.
- Comments and corrections on assignment copies will be given to students.

12. Indicative resources and recommended reading materials

Essential reading:

1. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2011). *Biochemistry* (7th edition), published by Freeman. ISBN 978-1429276351, £58.99.
2. Nelson, D.L. and Cox, M.M. (2013). *Principles of Biochemistry*, (6th edition), published by Freeman. ISBN 978-1464109621, £58.99.

3. Campbell *et al.* (2010). *Biology*, (10th edition 2014 or 9th edition), published by Pearson. ISBN 97-1292008653, £49.99.
4. Verma P. S. and Agarwal V. K. (2001) cell biology, genetics and molecular biology, 1st edition. New Delhi: Chanda and company

12.5 Human Anatomy and Physiology

Module Code:	Module No	Course name	Subject Units:	Credits
HAP 1513	5	Human Anatomy and Physiology	Human Anatomy	5
			Human Physiology	10

1. **Pre-requisite or requisite modules:** Cell Biology
2. **Administering Faculty:** FST
3. **Allocation of study and teaching hours**

le Module outline	Student hours	Lecture hours
Lectures	54	54
Structured exercises	16	16
Set reading		
Self-directed study	50	50
Assignments-preparation and writing	20	20
Examinations-revision and attendance	10	10
Total	150	150

4. Aims of the module

- The module aims to provide an introduction to the anatomy and in-depth cellular and systems physiology of the human body with an emphasis on homeostatic mechanisms.
- The module aims to develop an appreciation that physiological processes in whole tissues and systems can be understood in terms of the underlying cellular mechanisms, including chemical and electrical processes.

5. Learning Outcomes

By the end of the module, students should be able to:

Anatomy:

- Integrated concepts of topographical anatomy and organogenesis
- Locomotors system, Integrated biomechanics
- Bones: Vertebral column, trunk, limbs, head and the neck, joints, muscles, viscera of the head and the neck
- Spinal cord and spinal nerves, cranial nerves and the sense organs, sympathetic nervous system
- Heart, systematic circulation excluding the vessels of the lungs, pulmonary circulation including thoracic drainage ,vascularisation of the brain
- Lymphatic system, abdominal viscera, including their vascularisation and their Lymphatic drainage
- Genitor- urinary apparatus

Physiology

- Recognize the value of the concept of homeostasis and the mechanisms that have evolved to maintain it, and apply it at the cellular, systems and whole body level.

- Describe membrane transport processes and recognize the value of the different processes underpinning permeation across animal membranes including the roles of channels, carriers and pumps.
- Apply knowledge of membrane structure and function to understand the origins of the resting potential and of the action potential.
- Describe the principles of cellular signaling mechanisms including synaptic transmission at the neuromuscular junction and in the autonomic nervous system.
- Locate and describe the general organization and function of the main physiological systems of the body including:
 - ❖ Peripheral/autonomic nervous system
 - ❖ Spinal cord
 - ❖ Endocrine system
 - ❖ Skeletal muscle
 - ❖ Cardio-respiratory system
 - ❖ Renal system
 - ❖ Gastrointestinal system
- Discuss the basic organization of the two branches of the autonomic nervous systems and their role in the control of different body systems and tissues and the regulation of homeostasis.
- Describe the role of spinal cord in the control of posture, including reference to the motor unit, the muscle spindle, and spinal reflexes.
- Describe the organization and general function of the endocrine system.
- Apply knowledge of cellular muscle physiology to discuss the differences between excitation-contraction coupling in skeletal, cardiac, and smooth muscle.
- Explain the processes involved in moving air in and out of the lungs as well as the mechanisms responsible for gas exchange in lungs and tissues. Appreciate the role of the lungs in blood gas homeostasis and maintenance of plasma pH.
- Describe the homeostatic responses of the cardiovascular and respiratory systems at rest and the mechanisms involved in the control of heart rate, cardiac output and blood pressure.

- Describe the function of the gastrointestinal system and the kidneys in terms of membrane transport and other physical processes under neural and hormonal control.
- Integrate the function of the individual physiological systems into whole body physiology.
- Explain the inter-relationship of different body organs and systems.

Skills

- Demonstrate ability to identify different human body parts and systems.
- Demonstrate ability to identify common surface anatomical parts
- Demonstrate ability to apply knowledge of anatomy and physiology to the management of different life conditions.

Attitudes

Understand the relationship of anatomy, physiology and pharmacology with other program modules.

6. Indicative content

Human Anatomy

- Definitions
- Anatomic terminologies: definitions, positions, planes and cavities
- Embryological development of the human body
- Histology of different tissues
- Organization of human body skeleton and organs
- Organization of the nervous system; neurotransmitters and molecular receptors
- Different anatomical cell Structure and Function
- Respiratory system
- Cardiovascular system
- Human female & male reproductive system
- Renal system

- Digestive system

Human Physiology

- Digestive system, nutrition and metabolism , absorption , assimilation and secretion ejection_homeostasis
- Cellular homeostasis and membrane physiology – Permeation through channels, carriers and pumps.
- Cellular respiration
- Excitable Tissues – Resting membrane potentials and action potentials of nerve and muscle cells
- Spinal cord organization and its role in posture control; spinal reflexes.
- Organization and function of the endocrine system.
- Muscular contraction and its regulation.
- Respiration mechanics, gas exchanges in the lungs and blood transport of O₂ and CO₂.
- The kidneys and the regulation of body fluids.
- intracellular and extracellular compartments, body fluids , electrolytes and water balance
- Each student undertakes 2 practical classes that will provide a Human Physiological Profile based upon anatomical and physiological measurements including:
 - ❖ Human Electrophysiology.
 - ❖ Human Respiration.
 - ❖ Human Cardiovascular function.

7. Learning and teaching strategy

- Interactive lectures, Lectures, Demonstrations/Return demonstrations, Group discussions, team teaching.

8. Assessment strategy

Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation = 60 %; End of module assessment Exam = 40 %

9. Assessment pattern

Component	Weight (%)
Assignment	20
/CAT Test	40
Final assessment	40

10. Strategy for feedback and students support during module

- Verbal and written feedback, one-on-one discussion; group discussion; electronic means (Group e mail, website)

11. Teaching /Technical assistance

- Tutorial assistant staff, skills lab staff
- The lecture and practical class material will be supported during which students will engage in group discussions guided by study materials that will be provided as a workbook.

12. Indicative resources and recommended reading materials:

Core text

1. Mader S Sylvia. Understanding human anatomy and physiology.5th ed. Boston: McGraw Hill; 2005
2. Koepfen, B.M. and Stanton, B.A. (2010). "*Berne & Levy*" *Principles of Physiology*, (6th edition), published by Elsevier. ISBN 978-0323073622, RRP £71.99.
3. Boron, W.F. and Boulpaep, E.L. (2012) *Medical Physiology*, (2nd edition), published by Elsevier. ISBN 978-1437717532 RRP £73.99.

4. Guyton, A.C. and Hall, J.E. (2010) *Medical Physiology*, (12th edition), published by Elsevier. ISBN 978-1416045748, RRP £74.99.
5. Waugh Anne, Grant Allison. Ross and Wilson. *Anatomy and Physiology in Health and Illness*. Edinburgh: Churchill Livingstone; 2001
6. Silverthorn. *Human Physiology*4e (at www.physiologyplace.com)

12.6 Phlebotomy and Clinical Laboratory Specimen Management

Module Code:	Module N0	Course name	Subject Units	Credits:
PSM 1512	6	Phlebotomy and Specimens Management	1.Phlebotomy 2.Specimens Management	10

1. **Pre-requisite: Behavioral Sciences module**
2. **Administering Faculty: FST**
3. **Allocation of study and teaching hours**

Module outline	Student hours	Staff hours
Lectures/Face to Face	30	30
Seminars/workshops		
Practical classes/laboratory	35	35
Structured exercises	10	10
Set reading		
Self-directed study	10	10
Assignments-preparation and writing	10	10
Examination-revision and attendance	5	5
Total	100	100

5. Aim of the course:

- This course introduces the students to the processes and procedures of accurately performing phlebotomy, properly collecting, handling and preservation of various laboratory specimens.
- The study also introduces the students to good laboratory practice (GLP) and laboratory biosafety practices in the laboratory..

6. Learning Outcomes:

Knowledge:

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

- Learn aspects of Phlebotomy, collection of suitable specimens of stool, urine and other body fluids specimens apart from CSF.
- Describe collection methods for routine blood specimens including choice of correct anticoagulant and order of blood drawing.
- Demonstrate professional conduct and ethics and good laboratory practice during blood collection and use of standard operating procedures
- Describe and identify suitable blood collection containers for different laboratory investigations; Describe collection of hematology and blood transfusion tests, clinical chemistry tests, microbiology and immunology tests
- Describe methods of handling and preservation of laboratory specimens, the cold chain process for blood and blood specimens
- implement the standard turnaround time for blood collection
- Describe the process of good laboratory practice ; safety standards and use of different receptacles for different biological wastes ; infectious, non- infectious & sharps usage
- Identify infections that can be caused by non-sterile needle and sharps usage
- Define concepts of hand hygiene in health care delivery & explain the role of unclean hands in transmission of infections

- exercise professional conduct consistent with laboratory teamwork, patients care

Application of knowledge

- Demonstrate how to establish and create good interpersonal relationship with patients and other laboratory clients
- Exhibit professional behaviors
- Demonstrate how to verify patient identity against request forms
- Demonstrate how to collect suitable specimens for laboratory investigations

Practical skills

- Perform collection of routine laboratory specimens using appropriate containers and anticoagulants for laboratory investigations
- Label and apply procedures of accessioning blood specimens and perform specimen packing according to national and international guidelines for transportation of biological specimens
- Generate records for collected blood specimens
- Follow and exercise laboratory biosafety measures in the process of blood and other biological specimens collections
- Handle and dispose of laboratory wastes according to national biosafety regulations and guidelines
- Handle and preserve biological specimens according to laboratory quality standards

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures
- Follow directions of the instructor

7. Indicative Content

- Concepts and principles of good phlebotomy:
- Collection of routine blood, urine stool, pus, etc , in suitable containers for haematology and blood transfusion tests, clinical chemistry tests, microbiological and serological tests, etc.
- Labeling and accessioning specimens to meet transportation guidelines,
- Selecting the best vein, using appropriate anatomical approach.
- Special blood collection methods for non-routine situations; elderly, neonates, unconscious, uncooperative or difficult cases. Informed consent and right of refusal to laboratory procedure
- Limitations such as indwelling catheters, post-mastectomy or burns ,
- Proper use of anticoagulants and other blood tube additives
- Verification & identification of patient identity against request forms

- Laboratory specimens handling and preservation and long term storage; cold chain process for blood specimens and blood products
- Maintenance of records for collected specimens
- Definition of terms relevant to safety including universal precautions, hand hygiene and nosocomial infections, sterile needle and sharps usage and disposal
- Infections that can be caused by non-sterile needles and sharps
- Concepts of hand hygiene, role of unclean hands in transmission of infections and clean hands in prevention of nosocomial infections
- Core procedures of hand washing hygiene in health care delivery
- Standard turnaround time for specimens collection, keeping before testing
- Management of laboratory waste materials in specimen collection areas; Infectious materials, non-infectious, toxic materials, chemicals, sharp, etc.
- Accidents and incidents reporting and management
- Team work and communicating for quality laboratory services

8. Learning and teaching strategies:

Learning and teaching strategy will include lectures, demonstrations and practical exercises, self-directed learning, discussions and student presentations, group discussions, Power point presentations

9. Assessment strategy

- Phlebotomy & other specimens collection exercises, role play
- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation = 60 %; End of module assessment Exam = 40 %

10. Assessment

pattern

Component	Weight (%)
Assignments	20
CAT Test	40
Final assessment	40

11. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

12. Teaching /Technical Tools/ Assistance

- LDC Projector
- White board and markers
- Flip charts and markers
- Biosafety materials and Personal Protective Equipment (PPE)

12. Course materials- & recommended readings:

1. Procedures for the Collection of Diagnostic Blood Specimens by Venipuncture: Approved Standard (6th ed.). CLSI publication H3-A6. Wayne, PA: Clinical and Laboratory Standards Institute, 2007.
2. DiLorenzo, M.S., & Strasinger, S.K... Blood Collection: A Short Course (2nd ed.). Philadelphia: F.A. Davis, 2010

Level 1 (2nd semester)

12.7 .Pharmacology and Toxicology

Module Code:	Module N0	Course name	Subject Units	Credits:
PHT 1522	7	Pharmacology and Toxicology	1.Pharmacology 2. Toxicology	5 5

1. **Pre-requisite or requisite modules:** None
2. **Administering Faculty:** FST
3. **Allocation of study and teaching hours**

Module outline	Student hours	Lecturer hours
Lectures/Face to Face	36	36
Seminars/workshops	5	5
Practical classes/laboratory		
Structured exercises	10	10
Set reading		
Self-directed study	29	29
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10

Total	100	100
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4. Aims of the course

This course is designed to:

- Introduce students to the principles underlying the use of drugs in patients treatment
- Introduce students to the principles and methods pharmacodynamics of antibiotics in vivo.
- Introduce the students to various ways in which the toxic substances may be introduced in the body, their biotransformation and the laboratory procedures used to detect their presence in the body, food or drinks.

5. Learning outcomes

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

- Describe the pharmacokinetics and pharmacodynamics of the drugs in the body
- Monitor the therapeutic drug levels
- .Explain the principles of anti-biogram and antibiotic assays in body fluids
- Determine the efficacy of drugs/antibiotics

6. Indicative content

- Concepts and principles of drug: administration, absorption, distribution, metabolism and excretion
- Introduction to Pharmacology, Pharmacokinetic s & Pharmacodynamics principles
- Pharmacology, receptors & signaling – An introduction to pharmacological concepts, receptor function and signaling pathways; synaptic mechanisms
- Qualitative and quantitative analysis of drugs/drug metabolites in body fluids and tissues

- Introduction to Drug receptors & modes of drug action.
- General factors governing drug action – affinity, efficacy, biological variations with respect to drug actions dependence on drugs.
- Basic and Clinical Evaluation of new Drugs; Drug discovery, Preclinical Safety and Toxicity Testing, Evaluation in Humans, Clinical Trials.
- Drug interactions–enzyme induction, synergism, ‘potentiation and drug actions

7. Learning and teaching strategy

Interactive lectures, Lectures, Demonstrations/Return demonstrations, Group discussions, team teaching.

8. Assessment strategy

Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation =60 %; end of module assessment Exam = 40 %

9. Assessment pattern

Component	Weight (%)
In course Assignment	20
CATs	40
Final assessment	40

1. Strategy for feedback and students support during module

2. Teaching /Technical assistance

- Tutorial assistant staff, skills lab staff
- The lecture and practical class material will be supported during which students will engage in group discussions guided by study materials that will be provided

3. Indicative resources and recommended reading materials:

Test Books

1. Rang, H.P., Ritter, J.M., Flower, R.J. and Henderson, G. (2011). *Rang & Dale's Pharmacology*, (7th edition), published by Churchill Livingstone. ISBN 978-0702034718,
2. Basic & Clinical Pharmacology; by Bertram G. Katzung ; Lange Medical Books/ McGraw-Hill ISBN 0-8385-0598-8
3. Clinical Pharmacokinetics; Concepts and applications, by Malcolm Rowland & Thomas N. Tozer ; Lippincott Williams & Wilkins ISBN 0-683-07404-0

12.8 Medical Parasitology I and Entomology

1. Pre-requisite: Anatomy, physiology and cell biology
2. Administering Faculty: FST
3. Allocation of study and teaching hours

Code	Module NO	Module course	Subject Units	Credits
MPE 1522	8	Medical Parasitology I and Entomology	Medical Parasitology I & Entomology	10

Module outline	Student hours	Lecture hours
Lectures/Face to Face	30	30
Practical sessions	25	25
Seminars/workshops		
Structured exercises	5	5
Set reading	-	-
Self-directed study	20	20
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	100	100

5. Aims of the course:

- This module aims at enabling the students understand the concepts, pathophysiological principles, life cycles and transmissions, laboratory identification and diagnosis of parasites of medical importance.
- To explain the relationship between parasitic infections , primary hosts and secondary hosts ,
- Introducing to the concepts and science of medical entomology in order to understand the relationship with zoonotic diseases

6 Learning outcomes:

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

Describe the history of parasitology,define and explain parasitology terms.

- Describe the importance of carriers and host-parasite relationship
- Describe classification of parasites of medical importance into their various groups
- Discuss life cycles of parasites and relate them to diseases of man
- Describe the morphological features of different classes of parasites of medical importance at different developmental stages
- Review life cycles of different parasites of medical importance and their pathogenesis
- Describe methods used to stain and identify parasites
- Explain the principles for staining of parasites using normal saline, Lugol's iodine, dilute carborfascin for identification of different parasites
 - Perform accurate microscopic identification and diagnosis of intestinal parasites
 - Perform accurate identification and diagnosis of blood borne parasites

Knowledge:

- Review concepts of parasitology and parasitism
- Classify parasites according to their taxonomic group and where they are found in the human host

- Apply the principles of medical entomology to the understanding of disease transmission by insects

Critically evaluate methods for the control of vectors and assess the reasons for the current distribution of vectors in the world

Practical Skills:

- Apply the parasitology knowledge in the identification, laboratory diagnosis of parasites of medical importance
- Demonstrate the process and proper procedure for the collection of parasitology specimens
- Perform microscopic identification of protozoa in stool and blood
- Perform microscopic identification of intestinal, protozoa
- Perform microscopic identification of blood protozoa ,

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures in the laboratory

7. Indicative content:

- Introduction to medical parasitology
- Definition of parasitology terms: Parasitism: The concept of parasitism & parasite, carriers, host, Commensals, Intermediate hosts, Vectors
- Parasitic relationships; endo and ectoparasites; lifecycles of parasites; direct and indirect lifecycles; definitive and intermediate hosts; biological vector.
- Mechanical vector, reservoir host.
- Parasitic diseases and their mode of transmission
- Classification and characteristics of medically important parasites and geographical distribution.
- Morphology, life cycle, pathology/pathogenesis, epidemiology

- Biological specimen collection, transportation and preservation
- Describe the laboratory diagnosis of parasites , macroscopic ,microscopic examination of different specimens,
 - Explain the distribution, transmission, lifecycle and pathogenesis of protozoa of medical importance
 - Classify and describe diagnostic features and characteristics of protozoa of the protozoa of medical importance: amoeba, malaria, trypanosomes microfilaria etc,
- Explain the patho–physiological conditions caused by the protozoa

Entomology contents:

- **Concepts of entomology**
- Definitions of Terminologies
- Environmental entomology in general
- Zoonotic of medical importance
- **General structure and anatomy of arthropods:**
 - External features
 - Internal features
 - Dissection of a mosquito to see the internal organs
 - Classification of arthropods of medical importance.

Biology and Ecology of Insects and Arachnids

External morphology

Life cycle

Behaviour and ecology of immature and adult stages

Specific Control methods for the vector

General Control Methods of disease vectors

- Chemical Control
- Physical Control
- Biological Control

8. Learning and teaching Strategies:

- Learning and teaching strategy will include lectures, power point presentations, demonstrations and practical exercises
- Student self-directed learning, group discussions and presentations, ,

9. Assessment strategy

- Continuous assessment tests (CATs): Assignments, progress tests, practical activities evaluation, student presentation = 60 %; End of module assessment Exam = 40 %

10. Assessment

pattern

Component	Weight (%)
In- course assessment	20
CAT Test	40
Final assessment	40

11. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

12. Teaching /Technical Tools/ Assistance

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- Tutorial assistant
- Projector
- White board and markers
- Flip charts and markers

- Microscopes; light-binocular
- Parasitology reagents and materials
- Biosafety materials and PPE

13. Course materials -Indicative resources

Recommended Reading Texts:

1. Garcia, L S and Bruckner, D A (1997). Diagnostic Medical Parasitology 3rd edition. ASM Press.
2. Cook G C and Zumla, A (2003). Mansons Tropical Diseases 21st edition. ELST with Saunders.
3. Wahlgren, M and Perlman, P (1999). Malaria: Molecular and Clinical Aspects Publishers. Harwood Academic Publishers.
4. Bruce-Churatt, L.J. (1973) Malaria in Africa. 2nd Edition. Publishers: Blackwell
5. Gillespie S.H. and Hawksley P.M. (1994). Medical Parasitology: a practical approach. 3rd Edition. Publishers: Butterworth, Heinemann.
6. Chessbrough M. (2004) Tropical Medicine Parasitology. Publishers: Academic Press, London.
7. Bruce, F. And John D. (2003) Medical Entomology: A textbook on public health and veterinary problems caused by arthropods. Revised edition. Publishers: Kluwer Academic Publishers.
8. Mike W.S. (2005) Medical Entomology for Students. Third Edition. Publishers: Laboisier fr. Publishers.
9. Gullan P., and Cranston P. (2005) Insects: Outline of Entomology. Third Edition. Publishers: Blackwell Publishers.
10. Meyer, EA (ed): Human Parasitic Diseases. Vol. 3. Giardiasis. Elsevier, New York, 1999.
11. CH. Park, V. Iyengan, and L. Hefter, et al. Cutaneous *Acanthamoeba* infection associated with Acquired Immunodeficiency Syndrome Lab Med 25: (6) 386-388. 1994.

12. Garry, M. And Lance D. (2002) Medical and Veterinary Entomology. Third Edition. Publishers: ISBN.
13. Little V.A. (1972) General and Applied Entomology. Third Edition. Publishers: Harper and Row.
14. Robert F.H. and Maurice T.J. (1979) Entomology in human and animal health. Seventh Edition. Publishers: MacMillan Publishing Co.

Journals:

1. Journal of Tropical Medical Parasitology
2. Journal of Parasitology
3. Annals of Tropical Medicine and Parasitology
4. American Society of Tropical Medicine and Hygiene
5. Annual Review of Entomology
6. Journal of Medical Entomology
7. American Journal of Tropical Medicine and Hygiene

12. 9 General Microbiology

Module Code:	Module N0	Course name	Subject Units:	Credits:
GMI 1522	Module 9	General Microbiology	General Microbiology	10

1. **Pre-requisite: Cell biology**
2. Administering Faculty: FST
3. Allocation of study and teaching hours

Module outline	Student hours	Lecture hours
Lectures/Face to Face	36	36
Practical sessions	25	25
Seminars/workshops		
Structured exercises	5	5
Set reading	-	-
Self-directed study	14	14
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	100	100

5. Aim of the module:

- This course introduces students to general microbiology which will help them understand the later courses in detailed microbiology aspects.

Students will learn the morphological, the structural functions, characteristics of microorganisms.

6. Expected learning outcomes

Knowledge:

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

- Define the fundamental concepts in relation to diseases, of medical microbiology, virology, and mycology, Historical foundations microbiology and the scope.
- Describe the general anatomy and physiology of bacteria & comparison of eukaryotic and prokaryotic cells
- Describe and explain bacteria growth phases, reproduction, nutrition, explain bacterial genetics and pathogenesis, the role of bacterial genetics in infection
- Describe the major groups of pathogenic microorganisms and their importance to man, virulence factors and host-parasite relationship.
- Describe the types of specimen containers and prepare the different types of specimen containers (sterile containers, bottles, tubes, pipettes, and swabs).
- Describe the principles and practice of biosafe in microbiology laboratory , principles of sterilization & disinfection, waste management in laboratory
- Describe the principles and methods of bacterial staining processes, methods of bacterial culturing

Application of Knowledge:

- Classify all microorganisms according to their groups

Practical Skills:

- Perform microbial disinfection procedures using different techniques
- Perform microbial sterilization by autoclaving and dry heat methods
- Perform the procedure for bacteria staining using Gram's stain
- Demonstrate competencies to differentiate bacteria, microscopically and morphologically into gram positive and gram negative groups
- Perform the procedures for the preparation of different bacteria culture media

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures
- Follow directions of the instructor

7. Indicative course contents

- Explain the concepts, in relation to diseases, of microbiology , mycology and virology,
- Introduction to microbiology: historical concepts, scope, nomenclature classification of microorganisms of public health importance
- History, Development, Definitions, Terminologies
- Relationship between bacteria and environment
- Bacterial cell structure, function and morphology
- Classification, Genetics, Nutrition and growth of bacteria
- Mechanism of bacterial invasion, body response to bacterial invasion
- Bacterial Pathogenicity and virulence, host defense mechanisms. Infection & Disease
- Types of specimens for bacteriological investigations, preparation of specimen containers
- Bacterial stains, Staining methods

- Microscopically Identification of bacteria; Gram negative, Gram positive
- Culture methods, Incubation methods of bacteria, Inoculation, reading and interpreting culture plates
- Bacteria sterilization and disinfection methods; Describe the principles and methods of in-vitro destruction of microorganisms
- Biochemical and enzymatic tests for identification of bacteria
- Biosafety precautions in microbiology laboratory

8. Learning and teaching Strategies:

Learning and teaching strategy will include lectures, demonstrations and practical exercises, self-directed learning, discussions and student presentations, group discussions, Power point presentations

9. Assessment strategy

Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation = 60 %; End of module assessment Exam = 40 %

10. Assessment

pattern

Component	Weight (%)
In- course assessment	20
CAT Test	40
Final assessment	40

11. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

12. Teaching /Technical Tools/ Assistance

- ,
- Tutorial assistant
- Projector
- White board and markers
- Flip charts and markers
- Microscopes; light-binocular
- microbiology reagents and materials
- Biosafety materials and PPE

13. Indicative resources & recommended readings:

1. Medical Microbiology by Samuel Baron et al Galveston (TX) publishers
2. Modern Medical Microbiology: The Fundamentals by Stuart Clarke (Editor) Arnold Publishers (2004).
3. Medical Microbiology By Patrick R. Murray, Mosby (2009)
4. Medical microbiology by Mims, C. A., Playfair, J. H. L. et al., Mosby Publishers.
5. Designing a Modern Microbiological/Biomedical Laboratory by Jonathan Y. Richmond (Editor).

12. 10 Hematology I

Module Code:	Module N0	Course name	Subject Units:	Credits:
HEM 1522	10	Hematology I	Hematology I	10

1. Pre-requisite module: Anatomy, Physiology, cell biology, Phlebotomy
2. Administering Faculty: FST
3. Allocation of study and teaching hours

Module outline	Student hours	Lecture hours
Lectures/Face to Face	36	36
Practical sessions	25	25
Seminars/workshops		
Structured exercises	5	5
Set reading	-	-
Self-directed study	14	14
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	100	100

5. Aims of the module:

- This module introduces a student to basic principles and diagnostic techniques of hematology. It enables the student to understand subsequent modules in haematology.

6. Learning outcomes:

At the end of the course a student should be able to:

- describe the procedure for the collection of blood specimens for haematological tests analysis
- describe the procedure for preparation of blood specimen containers and blood smears hematological analysis
 - Describe; the reticulo-endothelial system, the process of haematopoiesis and maturation and different of blood cells
- Explain the principles and concepts in haematology.
- Morphology, structure and function of blood cells
- Define the following terms: anisocytosis, poikilocytosis, microcytic, macrocytic, normocytic, normochromic, hypochromic,
- Describe the haematological disorders in relation to normal parameters
- Explain the use and significance of the complete blood count tests and explain different hematological indices
- State the normal ranges for the following, giving male and female ranges or adult vs. infant/child ranges where appropriate: WBC, RBC, Hgb, Hct, PLT, MCV, MCH, MCHC, and RDW (State the ranges in both conventional units and SI units)
- Ensure Quality Control and Quality Assurance in haematology
- Demonstrate the procedure for the collection of suitable blood specimens
- Demonstrate the procedure for the preparation of thin and thick blood smears
- Demonstration the procedure and preparation of Romanosky stains
- Demonstrate and follow biosafety processes

7. Indicative content

- Introduction to haematology, the concepts of haematology. Reticulo-endothelial system
- The process of haematopoiesis, , Maturation and differenti of blood cells General blood physiology and formed elements of blood composition,
- Preparations of blood smears
- Red Blood Cell Indices and Calculations
- WBC Counts & differential of five classes of White Blood Cells , Red Blood Cell Count, , Platelet Count
- Code of conduct in hematology laboratory
- Definition and terminologies
- Types of normal hemoglobin, and abnormal hemoglobin (A , F , S,etc)

8. Practical Skills

- Perform the collection of suitable blood specimens for heamatological investigations, make thin and thick blood smears
- Preform complete blood counts, differentials using manual and automated methods, compare and interpret the results
- Evaluate the MCV, MCH, and MCHC in order to describe the predominant red blood cell and classify anemia.
- Perform ESR and interpret the results
- Perform the procedure for staining of thin and thick blood films

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures
- Follow directions of the instructor

9. Learning and teaching Strategies:

Learning and teaching strategy will include lectures, demonstrations and practical exercises, self-directed learning, discussions and student presentations, group discussions, Power point presentations

10. Assessment strategy

- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation = 60 %; End of module assessment Exam = 40 %

11. Assessment

pattern

Component	Weight (%)
In- course assessment	20
CAT Test	40
Final assessment	40

12. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

13. Teaching /Technical Tools/ Assistance

- Tutorial assistant
- Projector
- White board and markers
- Flip charts and markers
- Microscope
- Haematology reagents and materials
- Biosafety materials and Personal protective equipment

14. Indicative resources & recommended reading:

1. Lewis S.M. and Bates I. (2001). Practical Haematology (9th edition)
2. Hoffbrand, A.V., Essential Haematology, Blackwell Science Ltd (1992).

12.11 Analytical Chemistry and Instrumentations

Module Code:	Module N0	Course name	Subject Units:	Credits:
ACI 1522	11	Analytical Chemistry and Instrumentation	1. Analytical chemistry 2. Instrumentation	10

1. **Pre-requisite:**
2. Administering Faculty: FST
3. Allocation of study and teaching hours

Module outline	Student hours	Lecture hours
Lectures/Face to Face	36	36
Practical sessions	25	25
Seminars/workshops		
Structured exercises	5	5
Set reading	-	-
Self-directed study	14	14
Assignments-preparation and writing	10	210
Examination-revision and attendance	10	10
Total	100	100

5. Aims of the module:

- This course introduces the student to analytical chemistry/chemical detection and measurement. It provides a strong background to quantitative and qualitative analysis of biomedical specimens.
- It also provides a broad understanding of the principles of instrumentation operation in the process of, analytical identification, purification, separation and quantification techniques.

6. Learning Outcomes:

By the end of this module, students should be able to:

Knowledge

- Explain the fundamental principles of chemical measurements used in laboratory investigations and research studies.
- Describe the principles of operation for various laboratory analytical instruments: spectrophotometer, atomic emission photometer, atomic absorption photometer, electrophoresis, and chromatography.
- Explain instrument analytical principles applied in determination of constituents in biological fluids

Application of Knowledge

- Correctly handle and interpret experimental measurements, compare results and procedures, and calibrate analytical instrumentation.
- Apply the principles of qualitative and quantitative analysis for use in biomedical laboratories.

Practical Skills

- Perform the calibration of analytical instruments: spectrophotometers, photometers, and pH meters.
- Apply analytical procedures including volumetric analysis, potentiometric, spectrophotometry, and chromatography in analysis assays.
- Correctly interpret and handle experimental measurements.

- Perform the analytical procedures covered during the module on biological specimens.
- Demonstrate the calculations of the concentrations in biological specimens in percentages, moles and derivatives as per SI units
- Demonstrate proper use of biosafety tools in the laboratory

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures
- Follow directions of the instructor

7. Indicative of contents:

Acid / Base Reactions

- Acid & Bases
- pH & Buffers
- pH meter & Measurement of pH
- Mode of action of buffer solutions
- pH Indicators

Volumetric titrations and calculations.

Concentration of solutions:

- Volumetric analysis
- Molarity, Molality
- Standards solutions
- Neutralisation reactions
- Precipitation reactions
- Oxidation-Reduction reactions
- Expressing quantities and concentrations;

- Errors in chemical analysis;
- Treating random error;
- Statistical analysis of data and
- Analytical separations

Optical Spectrophotometry

- An introduction to photometry, spectrophotometry methods; instruments for optical spectrometry; molecular absorption spectroscopy; molecular fluorescence spectroscopy; atomic spectroscopy based on ultraviolet and visible radiation.

Electro-analytical Chemistry

- Theory of potentiometry; applications of potentiometry; electrogravimetric and coulometric methods; voltammetry.

Chromatographic Separations

- An introduction to chromatographic methods; gas-liquid chromatography; high-performance liquid chromatography.

Operation of medical laboratory instruments

- Microscopes
- Colorimeters
- Spectrophotometers ,
- Autoclave,
- Incubators,
- Blances,
- Water distillers,
- Centrifuges,
- Auto-analysers,
- Microtomes,

- Histokinettes,
- Bio safety hoods.

8. Learning and teaching Strategy:

- Lectures, tutorials, power point presentations, laboratory practical sessions,
- Student self-directed learning & group discussions &

9. Assessment Strategy:

- Continuous assessments, assignments, final assessment examination
- The continuous assessments, assignments will assess knowledge subject and of equipment used and correct interpretation of experimental measurements.
- The final examination will assess understanding of the principles and analytical equipment of as well as handling and interpretation of experimental results.
- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation = 60 %; end of module assessment Exam = 40 %

10. Assessment pattern

Component	Weight (%)
In-course assessment	20
CAT Tests	40
Final examination	40
Total	100

11. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

12. Teaching /Tools/ Technical assistance

- Tutorial assistants provide teaching backup and are actively involved during practical sessions and demonstrations.
- LCD projector and laptop used for power point projection.

13. Indicative resources and recommended readings:

1. Designing a Modern Microbiological/Biomedical Laboratory by Jonathan Y. Richmond (Editor)
2. Handbook of Laboratory Health and Safety by R. Scott Stricoff, Douglas B. Walters, 2nd Editions
3. CRC Handbook of Laboratory Safety by A. Keith Furr, Fifth Edition
4. Anderson C. S. and Cockayne S. Clinical chemistry concepts and applications; McGraw-Hill (2003).
5. Appleton & Lange's Outline Review Clinical Chemistry by Linda Gregory, C. Linda.
6. Shaunna A. and Cockayne S. (2003). Clinical chemistry; concepts and applications. (9th edition)
7. Karen Munson Ringsrud and Jean Jorgenson; Urinalysis and Body Fluids.
8. Lorraine J. Doucette; Mathematics for the Clinical Laboratory

12.12 Clinical Chemistry I

Module Code:	Module N0	Course name	Subject Units:	Credits:
CCH 1522	12	Clinical Chemistry I	1. Clinical Chemistry I	10

- 1. Pre-requisite: Biochemistry, Anatomy, physiology Analytical chemistry and instrumentation**
2. Administering Faculty: FST
3. Allocation of study and teaching hours

Module outline	Student hours	Lecture hours
Lectures/Face to Face	36	36
Practical sessions	25	25
Seminars/workshops		
Structured exercises	5	5
Set reading		
Self-directed study	14	14
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	100	100

5. Aims of the module:

- Clinical chemistry is the area of pathology that is concerned with qualitative & quantitative analysis of body fluids.
- The aim of this module is to introduce the students to clinical chemistry detection and quantitative measurements of organic and inorganic parameters in body biological fluids.

6. Learning Outcomes:

Knowledge

By the end of this module, students should be able to:

- Describe the procedure of the collection, storage and preservation of biological specimens for clinical chemistry analysis. Describe the sources of variation in biological specimens.
- Describe the appropriate use and principle of anticoagulants in clinical chemistry. Describe the methods for preparing reagents including water distillation and purification,
- Describe the laboratory glassware for clinical chemistry laboratory, care and calibration of volumetric equipment.
- Apply the biosafety precautions in a clinical chemistry laboratory
- Explain the principles of analyzing various contents of blood, urine, CSF and other body fluids.
- Perform practical clinical biochemical determinations of different parameters in different body fluids
- Describe the biological principles involved in the measurement of each body analytes in the clinical chemistry
- Differentiate between normal and diseased conditions according to body fluid parameter

- Explain the patho-physiological processes of urine formation; normal and abnormal constituents of urine
- Explain the principles for qualitative determination of various organic and inorganic constituents of urine

Application of Knowledge

- Correctly collect , handle and preserve the specimens for clinical chemistry analysis
- Correctly calibrate analytical instrumentation perform and interpret experimental measurements .
- Apply the principles of qualitative and semi quantitative and quantitative analysis on clinical specimens.

Practical Skills

- Demonstrate proper collection and handling of suitable clinical chemistry specimens: Urine, Blood
- Demonstrate the skills in operating clinical chemistry analytical instruments: spectrophotometer, photometer, etc. Perform practical clinical chemistry of complete urinalysis and interpretation of results
- Ensure quality control and quality assurance of analytical procedures and processes
- Demonstrate proper use of biosafety procedures and tools in clinical chemistry laboratory

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures
- Follow directions of the instructor

7. Indicative content:

- Introduction to clinical chemistry: history, concepts and relationship to other medical sciences, uses in clinical medicine
- Definitions and explanations of clinical chemistry terminologies; screening, monitoring, diagnosis, prognosis
- Description of different body fluids and their normal constituents: Whole blood, Plasma , Serum, Urine, Cerebral spinal fluid (C.S.F), Saliva and Sweat
- Anticoagulants,, use of anticoagulants in clinical chemistry;
- The patho-physiological processes of urine constituents, normal and abnormal constituents of urine
- Urine constituents (composition): Urine volume, appearance, odour, PH, Sugar, Protein, reducing substances, bile pigments, Bile salts, Ketone bodies.
- The principles for qualitative , semi-quantitative and quantitative determinations of various parameters in urine
- Units of measurement in (SI units) clinical chemistry and international standards
- Introduction to reference values, Quality assurance and quality control procedures
- Interpretation of results in relation to normal parameter results
- Precision and accurate measurements in clinical chemistry

Practicals

- Evaluation of urine volume, PH, appearance
- Qualitative and semi quantitative determination in urine of:
 - Proteins
 - Sugars
 - Ktones
 - Bilirubin
 - Bile salts

8. Learning and teaching Strategies:

- Learning and teaching strategy will include lectures, demonstrations and practical exercises, self-directed learning, discussions and student presentations, group discussions, Power point presentations

9. Assessment strategy

Continuous assessment tests (CAT): Assignments, progress tests, practical sessions evaluation, student presentations = 60 %; end of module exam = 40 %

10. Assessment

pattern

Component	Weight (%)
In- course assessment	20
CAT Test	40
Final assessment	40
Total	100

11. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

12. Teaching /Technical Tools/ Assistance

- laboratory assistant
- LDC Projector
- White board and markers
- Flip charts and markers
- Clinical chemistry instruments
- Clinical chemistry reagents and materials
- Biosafety materials and PPE

13. Course Indicative resources & Recommended Readings:

1. William J. Marshall, Stephen K Bangert, Márta Lapsley, 2012, *Clinical Chemistry: With STUDENT CONSULT Access, 7e*, Seventh Ed. [ISBN: 978-0723437031]
2. Anderson C. S. and Cockayne S. *Clinical chemistry concepts and applications*; McGraw-Hill (2003).
3. Shaunna A. and Cockayne S. (2003). *Clinical chemistry; concepts and applications*. (9th edition)
4. Karen Munson Ringsrud and Jean Jorgenson; *Urinalysis and Body Fluids*.
5. Lorraine J. Doucette; *Mathematics for the Clinical Laboratory*
6. David E. Golan. 2008. *Principles of pharmacology The Pathophysiologic Basis of Drug Therapy*. Lippincott Williams and Wilkins
7. Tripathi, K.D. 2008. *Essentials of medical pharmacology*. Jp Medical Pub

Level 2 (1st Semester)

12.13 Biostatistics

Module Code:	Module No	Course name	Subject Units:	Credits:
BSD 2512	Module 13	Biostatistics	1. Biostatistics	10

1. **Pre-requisite or requisite modules: Biology, descriptive statistics**
2. Administering Faculty: FST
3. Allocation of study and teaching hours

Module outline	Student hours	Lecture hours
Lectures/Face to Face	36	36
Practical sessions	20	20
Seminars/workshops	-	-
Structured exercises	10	10
Set reading	-	-
Self-directed study	14	14
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	100	100

5. Aim of the module

- The module introduces the students to biostatistical analysis methods of measurement and analysis..

6. Learning Outcomes

Knowledge

- Understand the concepts and principles of biostatistics
- Understand the theoretical and practical knowledge of biostatistics

Skills

- To apply biostatistical methods in collecting and analyzing research data
- To apply biostatistical data in solving in socio-economical problems

8. Indicative content

Biostatistics:

- Introduction to biostatistics, terminology and scales of measurement
- Definitions of data, population, sample and variable;
- Scales of measurement (types of data); and
- Descriptive and inferential analyses and their relevancy.
- Probabilities:
 - ❖ Introduction: variability in the life sciences
 - ❖ Combinations and probabilities
 - ❖ Conditional probabilities; Bayesian methods
- Data sources and data collection methods: Sources, quality and uses of data; Data collection methods and tools; tools development and data collection, sampling methods, sample size.
- Types of data; Data summary and presentation,

Computer data entry and analysis

- Frequency distributions
- Ratios, proportions, rates; and measures of central tendency, variation, position.
- Interpretation of Data.
 - ❖ Statistical Inference,
 - ❖ the scatter gram.
 - ❖ correlation;
 - ❖ the normal curve and standard scores;
 - ❖ confidence intervals,
 - ❖ The T-test
 - ❖ The chi-square distribution
 - ❖ - X^2 statistic,
 - ❖ hypothesis testing,
 - ❖ the P value,
- Hypothesis testing for continuous and categorical variables
 - ❖ T-test and Chi-square test interpretation of p -values, Multiple comparisons
 - ❖ ANOVA test, Comparisons of central tendency: parametric & non-parametric correlations

8. Learning and teaching strategy

- Lectures, brain storming demonstration, power point presentation Pilot studies will be used & group role plays
- Student group discussion & class presentation, , , , ,

9. Assessment strategy

- This comprises of continuous assessment tests, which will include group work with presentation, personal written test, practical test and final examination.
- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation =60 %; End of semester assessment Examination = 40 %

10. Assessment pattern

Component	Weight (%)
Assignment	20
CAT Test	40
Final assessment	40

11. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments will be given to students' copies to improve their performance.

12. Teaching /Technical assistance

- LDC Projector
- White board and markers
- Flip charts and markers

13. Indicative Resources:

Core text & Recommended Reading

1. Beaglehole, R. and Bonita, R.K. (2006). *Basic epidemiology*. Geneva: WHO
2. Ranjit K. (1996). *Research Methodology: A step-by-step Guide for Beginners*. Sage Publications. London
3. World Medical Association. Declaration of Helsinki: Human experimentation. World medical Association, Helsinki 1964 (modified 1975).
4. CIOMS. *International Ethical Guidelines for Biomedical Research Involving Human Subjects*. CIOMS. Geneva.
5. Corlien M. Varkevisser, Indra Pathmanathan, Ann Brownlee (2003). *Designing and Conducting Health Systems Research Projects Volume I: Proposal Development and Fieldwork*. WHO/IDRC. http://www.idrc.ca/en/ev-33011-201-1-DO_TOPIC.html

6. Corlien M. Varkevisser, Indra Pathmanathan, Ann Brownlee (2003). *Designing and Conducting Health Systems Research Projects Volume Volume II: Data analysis and report writing* WHO/IDR. http://www.idrc.ca/en/ev-33013-201-1-DO_TOPIC.html

12.14 Entrepreneurship

Module Code:	Module N0	Course name	Subject Units:	Credits:
ENT 2512	Module 14	Entrepreneurship	Entrepreneurship	10

1. **Pre-requisite or requisite modules:** None
2. Administering Faculty: FST
3. Allocation of study and teaching hours

Module outline	Student hours	Staff hours
Lectures/Face to Face	36	36
Seminars/workshops	5	5
Practical classes/laboratory		
Structured exercises	10	10
Set reading	5	5
Self-directed study	24	24
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	100	100

5. Aims of the module

- This module is designed to enable students to learn and apply the entrepreneurship skills
- To prepare students to meet the requirements of their role as leaders and managers of resources in their respective clinical setting
- To plan and initiate a venture in health services delivery, and to strive for excellence in their healthcare services by focusing on standards and criteria, accreditation, infection control, risk management and quality evaluation tools.

6. Learning Outcomes

At the end of the module the students should be able to:

- Explain entrepreneurship concepts and processes.
- Describe the best practice, opportunities, constraints in setting up and managing an enterprise.
- Demonstrate effective management skills for a business enterprise
- Apply technological tools and information system to manage a viable business.
- Understanding of financial and material resource management principles and procedures.

Skills

- Practice accountability in utilization of resources in order to achieve cost effectiveness in the delivery of health services.
- Utilize entrepreneur skills to create opportunities for career enrichment and increase client access to health care services.
- Initiate and formulate project proposals for income generating or/and health intervention

Attitudes

- Advocate for a positive working environment
- Prioritize workload and manage time effectively
- Appreciate the importance of honesty in financial management

7. Indicative content

- Introduction , definition of Entrepreneurship
- Concepts of entrepreneurship concepts, Principles of management and leadership
- Business plan, types of business ,Preparing a business plan (project) ,Marketing plan and research ,resource mobilization, budgeting and costing
- SWOT analysis:- strengths and weakness, opportunities and threats
- Inventory , feasibility studies
- Record keeping & financial management
- Customer care and client retention, Patents, trademarks, logos and intellectual property rights, legal frame work
- Government policy on business
- Business case studies

8. Learning and teaching strategies

- Teaching/learning strategies are selected and designed to facilitate the acquisition of the knowledge, skills, and attitudes essential and related for medical laboratory business practice.
- The following teaching and learning strategies will be used:
- Face to face lectures ,Self-directed learning, Group discussions, Group work presentation, Case studies Assignments, Reading and personal studies

9. Assessment strategy

- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation =60 %; End of module assessment Exam = 40 %

10. Assessment pattern

Component	Weight (%)
In-course assessment	20
CATs	40
Final assessment	40
Total	100

11. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

12. Teaching/ Technical assistance

- Simulated patients (SP simulation)
- Audio-visual material
- Projector

-

13. Indicative resources and recommended reading

Core text:

1. Booyens, S.W. (2008). *Introduction to health services management* (3rd Ed.). Cape Town: Juta Publishers.
2. Armstrong, M. (2006). *Strategic human resource management: a guide to action* (3rd Ed.). London and Philadelphia: Thomson-Shore, Inc: Publishers.
3. Offei, A.K., Bannerman, C. & Kyeremeh, K. (2004). *Healthcare manual for sub-districts*. Retrieved from http://ghanaqhp.org/fileadmin/user_upload/QHP/Healthcare_Quality_subdistrict.pdf
 - a. Accessed on May 16, 2013
4. Gapenski, L.C. (2007). *Understanding healthcare financial management* (5th Ed.). Health Administration Press, Chicago, Illinois AUPHA, Washington, DC.

Essential reading:

1. Evans, B. (2012). How to improve primary care by using significant event audit. *Primary Health Care*, 22(2), 26-29.
2. Hughes, R.G. (2008). *Patient safety and quality: an evidence-based handbook for nurses*. Retrieved from <http://www.ahrq.gov/professionals/clinicians-providers/resources/nursing/resources/nurseshdbk/nurseshdbk.pdf>
 - a. Accessed on May 16, 2013
3. Itika, J.S. (2011). Fundamentals of human resource management: emerging experiences from Africa. Retrieved from <http://www.ascleiden.nl/Pdf/APAM2.pdf>
 - a. Accessed on May 16, 2013
4. Wood, F. & Sangster, A. (2005). *Business accounting* (10th Ed.). Cape Town: Prentice Hall: Pearson Education.
5. Holeman, J. & Gilmore, N. (2010). *Risk management guide for physician practices*. Retrieved from..... Accessed on February 4, 2013
6. Loan, L.A., Jennings, B.M., Brosch, L.R., DePaul, D. & Hildreth, P. (2003). Indicators of nursing care quality. *Outcomes Management*, 7(2), 51-58.

Recommended Reading (illustrative):

1. World Health Organization. (2003). *Quality and accreditation in health care services: a global review*. Retrieved from..... Accessed on February 4, 2013
2. Pazargadi, M., Zafreshi, M.Z., Abedsaeedi, Z., Majd, H.A. & Lankshear, A.J. (2008). Proposing indicators for the development on nursing care quality in Iran. *International Nursing Review*, 55: 399-406.
3. Zoschak, E.W. (2010). Quality 10 indicators of excellent nursing care. *Trustee*: 28-30.

Background text

1. Booyens, S.W. (1998). *Dimensions of nursing management* (2nd Ed.). Cape Town: Juta Publishers
2. Anderson, J.A. (2010). Evolution of the health care quality journey: from cost reduction to facilitating patient safety. *The Journal of Legal Medicine*, 31: 59-72.
3. Bilawka, E. & Craig, B.J. (2003). Quality assurance in health care: past, present and future. *Int J Dent Hygiene*, 1: 159-168.

Electronic references

1. World Health Organization. (2011). *Country health information systems: a review of the current situation and trends*. Retrieved from..... Accessed on February 4, 2013
2. World Health Organization. (2006). Quality of care: a process for making strategic choices in health systems. Retrieved from..... Accessed on February 4, 2013
3. Legido-Quigley, H., McKnee, M., Nolte, E. & Glinos, I. A. (2008). Assuring the quality of healthcare in the European Union: a case for action. Retrieved from..... Accessed on February 4, 2013

12.15 Hematology II and Immuno-HematologyI

Module Code:	Module N0	Course name	Subject Units:	Credits:
HBT 2512	Module 15	Hematology II & Immunoematology I	Hematology II	10
			Immunoematology I	5

1. Pre-requisite or requisite modules: Anatomy, Physiology, Cell biology, Heamatology I

2. Administering Faculty: FST

3. Allocation of study and teaching hours

Module outline	Student hours	Lecturer hours
Lectures, face to face	45	45
Seminars/workshops		
Practical classes	40	40
Structured exercises	5	5
Set reading etc.		
Self-directed study	40	40
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	150	150

5. Aims of the module

- This module is intended to equip the students with the hematologic theory and diagnostic principles including, identification of normal and abnormal blood cells as they correlate to disease.
- The study also introduces the student to immune-hematological concepts and systems of blood coagulation and fibrinolytic mechanisms.
- The Students will learn the knowledge and skills needed to perform medical laboratory investigations in hematology and coagulation.

6 Learning outcomes:

Knowledge:

Upon completion of this module the student will be able to:

- Classify and describe blood picture of various anaemias.
- Describe different types of haemoglobinopathies and state their causes.
- Describe the use of radioactive nuclides in haematology.
- Explain the principles of blood grouping and compatibility testing
- Perform ABO and Rhesus blood grouping
- Describe the procedure to perform routine, automated and manual, hematological tests, including the cell differential and morphology, and paraphrase the principles for each, as well as selected “special” hematology analyses.
- Interpret and evaluate results for each analysis, applying theory to predict possible disease states.
- Describe the procedures to perform and evaluate routine coagulation analyses by automated or semi-automated methods, and apply quality control procedures with the required competencies .
- Explain the major hemostatic characteristics and causes of the following coagulation disorders: Fibrinogen deficiency, Hemophilias A and B, von Willebrand’s Disease, disseminated intravascular coagulation/fibrinolysis, and hypercoagulable states.

Application of Knowledge

- Demonstrate the ability to calculate the indices and classify anemia morphologically given a set of red cell indices, the hematocrit, hemoglobin, and red cell count. .
- Describe the main clinical manifestations of anemia.
- Evaluate the laboratory criteria for defining anemia.
- Interpret results from coagulation tests.
- Using the CBC as the basis of the laboratory assessment of anemia, identify the particular findings in the CBC that are indicative of anemia.

Practical Skills

- Perform complete blood count tests by automation and manual methods
- Demonstrate the ability to calculate the haematological indices
- Perform the microscopic identification of different normal blood cells
- Perform and interpret ABO blood grouping tests, compatibility tests, antiglobulin tests and related diagnostic procedures

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures
- Follow directions of the instructor

7. Indicative contents:

Haematology& Blood coagulation

- Definition of key terms: blood disorders
-

- Laboratory diagnosis and treatment; thrombosis and anti-thrombotic therapy, Clinical features and pathology
- Classification of anemias,
 - ❖ Anemia in clinical and laboratory terms,
 - ❖ Physiologic compensation for anemia
 - ❖ classification of anemia based upon RBC
 - ❖ normocytic
 - ❖ Microcytic, ,
 - ❖ macrocytic anemia,
 - ❖ RBC indices,
 - Hemoglobin and hematocrit parameters Etiological classifications of anemias,:
 - ❖ decreased RBC production,
 - ❖ ineffective RBC or hemoglobin production,
 - ❖ Deficiency of globin production;
 - ❖ thalassemias; hemoglobinopathies
- Deficiencies of haeme synthesis;
 - increase in RBC destruction (Loss),
 - intravascular hemolysis,
 - ❖ extravascular hemolysis,
 - ❖ acute blood loss
 - ❖ Abnormal blood cells production
- Bleeding disorders, causes,
 - ascular abnormalities,
 - latelet abnormalities,
 - ereditary & acquired coagulation disorders,

Immuno haematology Unit

- Pregnancy and pediatric haematology;;
- neonatal haematology
- Hemolytic diseases of thenwborn (HDN)

- Definitions of the common terminologies used in blood transfusion science like:
 - antigens,
 - antibodies,
 - genotype,
 - phenotype, etc
- erythrocyte membrane,
- genetic transmission of antigens;
- erythrocyte antigens;
- blood group nomenclature,
- anti-erythrocyte antibodies; Definition, structure and class, common properties, specific properties
- Immune response in blood transfusion;
 - causes of immune response,
 - primary and secondary immune response,
 - factors of immune response,
 - complement activation and its biological effect,
 - definition, role and biological activity of complement activation,
 - effect of complement activation
- Mechanisms of antigen/antibody reactions:
 - introduction, forces involved in Ag-Ab reaction
 - Direct agglutination,
 - artificial agglutination,
 - interaction of sensitized red cells with immune system
- Blood group systems: ABO,
- Rhesus, Lewis system,
- Hh System,
- Ii system,
- P system,
- Lutheran system,
- Immunogenic systems (Kell, Kidd, Duffy, MNSs),

- platelet and leukocyte antigens and antibodies (organ/tissue transplantation), polyagglutinability antigens:

- hereditary,
- acquired (microbial), non-microbial

Auto-antigens and auto-antibodies of the Major Histocompatibility Complex (MHC), definition, composition, HLA (Human leukocyte antigen) system

8. Learning and teaching strategies:

- Learning and teaching strategy will include lectures, demonstrations and practical exercises, self-directed learning, discussions and student presentations, group discussions, Power point presentations

9. Assessment strategy

- Phlebotomy & other specimens collection exercises, role play
- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation = 60 %; end of module assessment exam = 40 %

10. Assessment

pattern

Component	Weight (%)
Assignments	20
CAT Test	40
Final assessment	40

11. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

12. Teaching /Technical Tools/ Assistance

- Tutorial assistant

- LDC Projector
- White board and markers
- Flip charts and markers
- Microscopy
- Haematology reagents and materials
- Immunohaematology reagents and materials

Biosafety materials and PPE

13. Indicative resources & Recommended Reading:

1. Shodja M. M. Hematology for CLS and MLT ISBN - 13: 9781426943997
2. American Association of Blood Banks : Technical Manual, 14th edition, AABB Press, Bethesda, 2003
3. PL Mollison, CP Engelfriet, Marcela Contrelas : Blood Transfusion in Clinical Medecine, 9th edition, 1993
4. American Association of Blood Banks: Transfusion Therapy, Clinical Principles and Practice, AABB Press, 2nd edition, Bethesda, 2005
5. American Association of Blood Banks : Transfusion Reactions 2nd edition, AABB Press, Bethesda, 2001
6. B Genetet, G Andreu, JM Bidet : Aide mémoire de Transfusion Sanguine, Flammarion,
7. American Association of Blood Banks : Practical Guide to Blood Transfusion, AABB Press, Bethesda, 2001
8. European Commission : Safe Blood in Developing Countries, Principles and organisation, 1995
9. C Sultan, M Gouault, Heilmann, M Imbert : Aide Mémoire d'Hématologie, Flammarion, 1987
10. Journals Transfusion, Journal of Immunology, Le recrutement des donneurs de sang volontaires (IFRC)

12.16 Histology and Cytopathology

Code:	Module N0	Course name:	Course units:	Credits:
HCY 2512	Module 16:	Histology and Cytopathology	Histology and Cytopathology	10

1. Pre-requisite modules: Cell biology, Anatomy & Physiology
2. Administering Faculty: FST
3. Allocation of study and teaching hours

Module outline	Student hours	Lecture hours
Lectures	36	36
Seminar/Workshop		
Practical class laboratory	25	25
Structured exercises	5	5
Set readings etc.		
Self-direct study	14	14
Assignments	10	10
Revision and examination	10	10
Invigilation		6
Total hours	100	100

4. Aims of the Module

- The module introduces microscopic structure, morphology of cellular, tissue & organs in normal conditions and the relationship between structure and function.
- The module aims at empowering the students to understand the principles and roles of histology and cytopathology in diagnosis of tissue abnormalities.
- The module also includes basic histotechniques & cytopathology techniques for slide preparations for diagnosis of cytopathology conditions

5. Learning Outcomes:

At the end of this module the students should be able to:

Knowledge

- Describe the normal structure tissues
- Explain the concepts, principles and roles of histology and cytopathology in diagnosis of tissue diseases
 - Define common terminologies used in cytopathology
 - Define the terminologies associated with malignant conditions
 - Describe elementary cellular and main tissue lesions, in metabolic disorders
 - Recognize tissue lesions due to inflammatory processes, microorganisms
 - Describe hemodynamic disturbances in histological and cytological techniques
- describe the post-mortem changes in tissues and cells and methods for preserving cellular structure
- Describe the properties and modes of action of various tissue fixatives
- Describe the procedures for histological and cytological staining techniques of various cells
- Evaluate the quality of results by different staining techniques

Practica skills:

- Prepare and quality control staining reagents

- Perform the procedures for histotechniques and cytotechniques in staining and identification of tissues and cells. Perform histological and special staining procedures
- Perform fixation of tissues, smears and fluids
- Perform microscopic evaluation of stained cells and tissues, to evaluate the quality of staining techniques.
- Microscopically differentiate normal human cells and tissues;
- perform Papanicolau staining on cytological specimens
- Recognize in microscopic sections, the following conditions or lesions: metabolic disorders; inflammatory processes; hemodynamic disturbances; malignant conditions

Recognize lesions due to inflammatory processes and recognize microorganisms in the tissue

6. Indicative contents

- Describe the characteristics and modes of action of different fixatives
- Describe the procedures for the preparation of fixatives, dehydration , clearing and staining reagents
- describe the procedures for histological and cytological techniques; Papanicolau staining on cytologic specimens
- Describe the safety safety rules to be followed in histopathology laboratory (Biohazard, Physical, Chemical); biohazard and chemical safety issues and precautions
-
- identify the special stain procedure which will best demonstrate the condition of the tissue
- Describe the procedures for mounting of aqueous and resinous sections

Describe the staining quality evaluation criteria for the cytopathology staining results of special stains procedures:

- ❖ Papanicolau (pap smear)
- ❖ FNAC (fine needle aspiration cytology)

❖ Cytology screening

Attitude

- Demonstrate teamwork in completion of laboratory tests
- Demonstrate communication skills and use of the microscope according to guidelines
- Effectively collaborate with peers, communicate and team work to solve work related histological issues
- Effectively apply professional ethics and good laboratory practices

7. Teaching and learning strategies

- Basic factual material is discussed in lectures and seminars, and practical skills are acquired and practiced in the laboratory. Face-to-face interaction, Presentation, Group work and Assignment/individual research shall all be used. Students will be expected to undertake directed learning following each lecture to complement the taught topics and independent learning is required to reinforce the student's knowledge, e.g. in relation to coursework assignments and the final examination.

8. Assessment strategy:

- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation = 60 %; End of module assessment Exam = 40 %

9. Assessment Pattern:

Component	Weighting (%)
In-course assessment Assignments and seminars	20
CATs	40
Final assessment	40
Total	100

10. Strategy for feedback and student support during module

- Class assignments and continuous assessment will be corrected and discussed in class just after receiving the marks.
- The teaching team is obliged to avail at least one hour each day during the module delivery to meet students with specific problems.

11. Indicative Resources & recommended reading

Text Books

1. David. E. ELDER, *Histopathology of skin*, Lippincott, New Delhi, 2004
2. Guy ORCHARD and BRIAN, *Histopathology (Fundamentals of Biomedical Science)*, Lippincott, New Delhi, 2007
3. Moran & Rowley, *Histology Text Atlas, Histology*, Lippincott, New Delhi, 2007
4. V.P. EROSCHENKO, *Atlas of Histology*, the Point, Delhi, 2004
5. D.H. CORMACK, *Essential Histology*, Lippincott-Riven, the Point, Delhi , 1999
6. B.K.B BERKOVITZ et al., *Oral anatomy, Histology and Embryology*, Morsby, Toronto, 2002
7. Thomas SADLER (Lippincot Williams), *Medical Embryology*, editions of : Langman's, 2010
8. Micheal ROSS, Wojciech PAWLINA, *Histology: A Text and Atlas: With Correlated Cell and Molecular Biology (Histology (Ross))*, 2008
9. John t. HANSEN, *Atlas of Human Anatomy: with Student Consult Access (Netter Basic Science)*, 2007

Key websites and on-line resources

1. www.amazon.com/s?...n%3A283155%2Ck%3AHistopatholog..
2. www.stmbooks.co.uk/acatalog/Histopathology_Books.html
3. medicalebooks-aslam.blogspot.com/.../new-added-histology-b
4. www.visualhistology.com/products/atlas/index.html
5. www.pathologyoutlines.com/bookshistology.html

6. www.pathologyoutlines.com/books1.html
7. www.us.elsevierhealth.com/Medicine/Pathology/ - United States
8. www.springer.com › [Home](#) › [Medicine](#) › [Pathology](#)
9. www.amazon.com/s?...histology...n%3A283155%2Ck%3Ahist
10. www.books.google.com › [Medical](#) › [Histology](#)
11. www.freebookcentre.net › [Medical Books](#)
12. www.valorebooks.com/books/medical/histology
13. www.medicalebooks-aslam.blogspot.com/.../new-added-histology-b..

Module 17: Clinical Chemistry II

12.17 Clinical Chemistry II

Module Code:	Module N0	Course name	Subject Units:	Credits:
CCH 2512	Module 17	Clinical Chemistry II	Clinical Chemistry II	10

1. **Pre-requisite: Anatomy, physiology, cell biology, Biochemistry & Clinical Chemistry I**
2. Administering Faculty: FST
3. Allocation of study and teaching hours

Module outline	Student hours	Lecture hours
Lectures/Face to Face	36	36
Practical sessions	25	25
Seminars/workshops		
Structured exercises		
Set reading	-	-
Self-directed study	19	19
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10

Total	100	100
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5. Aim of the module:

- This course aims at equipping the students with deep knowledge and understanding of the principles of laboratory diagnosis of different diseases using clinical chemistry parameters.
- To build students' capacity in performing laboratory investigations of liver function, kidney function, parameters, protein profile, clinical enzymology hydrogen ions and acid base balance and blood gases.
- The module also aims at emphasizing quality control applications in clinical chemistry laboratory

6. Learning outcomes

Knowledge

At the completion of this module the student should be able to:

- Explain the diseases associated with carbohydrate metabolism and their laboratory diagnosis.
- Explain the physiological processes and pathological analysis of blood constituents related to carbohydrate metabolism
- Discuss different laboratory methods and techniques for diagnosis of diabetes mellitus and explain how glucose, ketones, fatty acids are related in a patient with diabetes mellitus
- Describe the procedures for the laboratory analysis of serum, plasma, for the diagnosis of liver, kidney, cardiac and other organ diseases
- Explain the quality assurance and quality control principles and applications in clinical chemistry laboratory.

Application of Knowledge

- Apply principles, analytical systems, and procedures of analysis on different biological specimens for diagnosis of different diseases
- Apply quality assurance and quality control principles in order to obtain accurate , reliable results

Apply theoretical knowledge to evaluate the accuracy and reliability of analytical results in relation to quality control results

Practical Skills

- Analytical tests and interpretation of the results in relation to clinical information
- Analysis of biological specimens using different semi-automated and automated methods based on the principles:
 - of, photometric
 - spectrophotometry

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures
- Follow directions of the instructor

7. Indicative Content:

- ❖ Principles and procedures of analysis of blood constituents: Blood electrolytes: sodium, potassium, chloride, bicarbonate, lithium
- ❖ Glucose, Glucose tolerance test,
- ❖ Proteins: Albumin, total protein , ,
- ❖ Renal function tests: creatinine, uric acid, urea
- ❖ Liver function tests: bilirubin, alkaline phosphatase, alanine transferase, aspartate transferase, Gama glutamate transferase
- ❖ Cardiac function tests, ,
- ❖ pancreas function tests: Amylase, lipase

- ❖ mminerals: calcium, phosphorous,
- ❖ lipid profiles: triglycerides, total cholesterol, LDL cholesterol, HDL cholesterol
- Apply quality control tests and procedures

Practicals skills

- Perform analysis of the concentrations in blood of :
 - ❖ Electrolytes,
 - ❖ Glucose,
 - ❖ Proteins, blood urea ,
 - ❖ Creatinine, uric acid,
 - ❖ Liver function tests,
 - ❖ Cardiac function tests,
 - ❖ Renal function tests,
 - ❖ Pancreatic function
 - ❖ Plasma enzymes,
 - ❖ Mminerals
 - ❖ Lipid profile
- Perform quality control results tests and analysis of results

8. Learning and teaching strategies:

- Learning and teaching strategy will include lectures, demonstrations and practical exercises, self-directed learning, discussions and student presentations, group discussions, Power point presentations

9. Assessment strategy

- Phlebotomy & other specimens collection exercises, role play
- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation = 60 %; end of module assessment exam = 40 %

10. Assessment

pattern

Component	Weight (%)
Assignments	20
CAT Test	40
Final assessment	40

11. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

12. Teaching /Technical Tools/ Assistance

- LDC Projector
- White board and markers
- Flip charts and markers
- Clinical chemistry instruments
- Clinical chemistry reagents and materials
- Biosafety materials and PPE

13. Indicative resources & Recommended Reading:

1. Anderson C. S. and Cockayne S. Clinical chemistry concepts and applications; McGraw-Hill (2003).
2. Appleton & Lange's Outline Review Clinical Chemistry by Linda Gregory, C. Linda.

3. Barbra H. Estridge, Anna P. Reynolds. Basic Clinical Laboratory Techniques
4. Clinical Chemistry, William J. Marshall Stephen K. Bangert. Sixth Edition
5. Lecture notes in Clinical Biochemistry 6th Edition, AF. Smith, GJ. Beckett, SW. Walker, PWH. Rae
6. Introduction to Medical Laboratory Technology 7th Edition, FJ. Baker, RE. Silverton, CJ. Pallister.
7. A manual of Lab Diagnostic Tests 5th Edition, Frances Fischbach
8. MN Chatterjea, RChawla, Clinical Chemistry 2nd edition (2010)
9. Robert F. Dons and Frank H. Wians, Jr Endocrine and Metabolic Disorders fourth edition (2009)
10. Robert W. McKenna, Joseph H. Keffer, The handbook of Clinical Pathology 2nd edition

Further reading

1. L. Kaplan, AJ. Pesce. Clinical Chemistry: Theory, Analysis, Correlation 3rd edition.
2. L. Kaplan, AJ. Pesce. Clinical Chemistry: Theory, Analysis, Correlation 5th edition.
3. Carl A. Burtis, Edward R. Ashwood, David E. Bruns, Tietz text book of Clinical Chemistry and Molecular Diagnostics 5th edition

Journal references

11. Levy S. Jennings ER. The use of control charts in the clinical laboratory. American Journal of Clinical Pathology.

Website references

1. www.pubmedcentral.nih; www.clinchem.org; www.medex.org.uk; www.datacollection.eu
2. www.westgard.com; www.andrew.edu; www.labtestsonline.org

12.18 Bacteriology I

Module Code:	Module N0	Course name	Subject Units:	Credits:
MMI 2522	Module 18	Bacteriology I	Bacteriology I	10

1. Pre-requisite: Cell biology, physiology, General Microbiology
2. Administering Faculty: FST
3. Allocation of study and teaching hours

Module outline	Student hours	Staff hours
Lectures/Face to Face	36	36
Seminars/workshops		
Practical sessions	25	25
Structured exercises		
Set reading		
Self-directed study	19	19
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	100	100

4. Aims of the module:

- This module aims at empowering the student deep knowledge of to understand the pathogenesis of bacterial infections diseases.
- The module will also provide to the students understanding and knowledge of the types of immune response against bacteria.
- The practical skill sessions are focused on culture techniques, methods details of staining and the microscopic diagnosis, colonial and biochemical identification of microorganisms.

6. Learning Outcomes:

At the end of this module student should be able to:

Knowledge

- Draw a typical microbial growth curve, and predict the effect of different environmental conditions on the curve of growth and survival.
- Detailed Classification of bacteria into gram positive and gram negative bacteria
 - Gram positive cocci in chains, clusters and bacilli cocobacilli,
 - Gram negative cocci and bacilli, intracellular,
 - Characteristics of each group of bacteria
 - bacteria toxins, enzymes
 - pathogenecity and virulence,
 - Immune response to bacterial infection

Application of Practical skills

- Demonstrate competencies in staining techniques and tests for identifying bacteria species.
- Demonstrate competencies in microscopic diagnosis of bacterial infections
- Demonstrate competencies in systematic bacteriology for the identification of different bacterial species; bacteria cultures, subculture, serotyping, biochemical reactions and interpretation of results.

- Demonstrate competencies in bacterial susceptibility tests and interpretation of results
-

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures
- Follow directions of the instructor

6. Indicative content:

Classification of bacteria into gram positive and gram negative

- Morphological and structural description of
- Gram positive bacteria .A
- Activity at site of infection, virulence, toxins, bacterial enzymes
- Gram negative bacteria
- Activity at site of infection, virulence, toxins, bacterial enzymes by gram negative
- Differential characteristics of gram positive and gram neagativebacteria
- Comperative pathogenesis of each group .Immune response,

Practicals

- Perform gram staining techniques
- Perform biochemical bacteria identification tests.
 - ❖ Catalase
 - ❖ Oxidase
 - ❖ Glucose fermentation
 - ❖ Lactose fermentation
 - ❖ Hydrogen sulfide
 - ❖ Gas production
- Demonstrate competencies in microscopic diagnosis of bacterial infections

- Demonstrate competencies in systematic bacteriology for the identification of different bacterial species; bacteria cultures, subculture, serotyping, biochemical reactions and interpretation of results.
- Demonstrate competencies in bacterial susceptibility tests and interpretation of results
- perform serology typing test, animal inoculation
- Anti-microbial sensitivity testing: tube dilution and disc diffusion methods
- Criteria for choice of antibiotics

5. Teaching Strategies:

- A variety of teaching and learning strategies will be adopted in this module including: lectures, self-directed learning, discussions and student presentations, group work, case studies, demonstrations and practical exercise, audio-visual.

6. Assessment Strategies:

- Written examination (test) to assess the student's knowledge and understanding of pathogenic bacteriology.
- Practical examination to assess the student's practical skills in the diagnosis of different bacteria in the laboratory.
- Written assignment, the purpose of which is to help students' present case history of selected bacterial diseases.
- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation =60 %; End of module assessment Exam = 40 %

9. Assessment Pattern:

Component	Weight (%)
In-course assessment	
Assignments	20
Tests	40
Final assessment	40

9. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

10. Teaching /Technical assistance

- Tutorial assistants provide teaching backup and are actively involved during practical sessions and demonstrations. LCD projector and laptop used for power point projection.

12. Indicative resources & rrecommended readings:

1. Sherris *Medical Microbiology* 6th (ed) by Keneth J Ryan et al. 2014. McGraw-Hill
2. Collee JG (1996).Mackey and McCartney-Practical Medical Microbiology, 14th (ed). Churchill Livingstone.
3. Davis, B.D., and R. Dulbecco. (1990).Sterilization and Disinfection. In B.D.Davis *et al.* ed., *Microbiology*, 4th (ed). J.B. Lippincot Company, Philadelphia.

4. Holt, J.G. (ed).1984-1989.*Bergey's Manual of Systemic Bacteriology*, 4 vols.Williams and Wilkins, Baltimore, MD.
- Eugene W. Nester, C. Evans Roberts, Nancy N. Pearsall, Denise G. Anderson and Martha T. Nester (1998). *Microbiology; a Human Perspective* 2nd ed.WCB/McGraw-Hill.

12.19: Medical Parasitology II

1. **Pre-requisite:** Anatomy, physiology, cell biology & medical parasitology I& entomology
2. **The lectures will be student centered and interactive**
3. **Allocation of study and teaching hours**

Module Code:	Module N0	Course name	Subject Units:	Credits:
MPE 2511	Module 19	Medical Parasitology II	1.Medical parasitology II	5

4. Aims of this module

- This course is designed to enable students to study and understand the principles pathophysiology and methods of laboratory identification and diagnosis of protozoa, , .

5. Learning outcomes

Knowledge

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

- Classify and describe detailed characteristics and diagnostic features of helminths: of medical importance: Cestodes, Trematodes, Nematodes,etc

- Explain the procedures and techniques for laboratory quality assurance and quality control in the diagnosis of parasitic infections

Practical Skills

- Collect suitable specimens for accurate microscopic diagnosis of intestinal and blood parasites:
- Demonstrate the ability to perform microscopic identification and diagnosis of intestinal and tissue nematodes, cestodes, trematodes,
- etc,

6. Indicative contents

- Distribution; transmission; lifecycle; clinical manifestations and pathology; prevention and control; 1
- Collection methods of stool and blood specimens for parasitic infections diagnosis
- Laboratory methods and diagnosis of the following:
 - ❖ Perform microscopic identification of intestinal nematodes, caestodes, trematodes,
 - ❖ Perform microscopic identification of blood nematodes , ,
 - ❖ Mastigiphora,
 - ❖ Cilliophora
 - ❖ Blood flagellates (Trypanosomes; Leishmania spp)
 - ❖ Intestinal and urinary flagellets; Trichomonas,
 - ❖ Giardia
 - ❖ .Sarcodina:
 - ❖ Amoebae spp
- Microscopic examination using specialized staining techniques eg,
- *Toxoplasma gondii*,

- *Isospora belli*,
- Cryptosporidium spp

8. Learning and teaching Strategies:

- Learning and teaching strategy will include lectures, demonstrations and practical exercises, self-directed learning, discussions and student presentations, group discussions, Power point presentations

9. Assessment strategy

- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation = 60 %; End of module assessment Exam = 40 %

10. Assessment pattern

Component	Weight (%)
In- course assessment	20
CAT Test	40
Final assessment	40
Total	100

11. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

12. Teaching /Technical Tools/ Assistance

- Laboratory assistant
- LDC Projector
- White board and markers
- Flip charts and markers
- Parasitology diagnostic instruments
- Parasitology reagents and materials
- Biosafety materials and PPE

13. References and recommended reading materials

1. Gillespie S.H. and Hawskey P.M. (1994). *Medical Parasitology. A Practical Approach*. (3rd edition)

12.20 Immunology I and Virology

Module Code:	Module N0	Course name	Subject Units:	Credits:
IMV 2523	Module 20:	Immunology I and Virology	1. Immunology I	10
			2.Virology	5

1. Pre-requisite: Biochemistry, anatomy, physiology & cell biology

3. Administering Faculty: FST

4. Allocation of study and teaching hours

Module outline	Student hours	Lecture hours
Lecture	54	54
Seminars/workshops		
Practical classes/Laboratory	45	45
Self-directed study	31	31
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	150	150

5. Aims of the module:

- This module aims at providing a general concepts, knowledge and deep understanding of medical virology.
- This course introduces students to the basic principles and concepts of immunology in order to understand the body response to infection and as a tool for disease diagnosis
- This module provides introduction to the components of the immune system and provide a theoretical basis for clinical immunological testing with regard to principal of assays, their limitations and interpretations of results.

7. Learning Outcomes

At the end of this module students are expected to:

Knowledge

Virology Unit

- Explain the fundamental concepts of virology and terminology used in medical virology.
- Describe common characteristics of viruses; structure, size, morphology, genetic makeup.
- Explain the pathogenesis, and epidemiology, of different groups and species of viruses.
- oetus
- Describe the pathogenesis, epidemiology, diagnosis, prevention and control of diseases caused by RNA and DNA Viruses.
- List the most common viruses responsible for and found in the respiratory tract, Gastrointestinal tract, central nervous system,
- List the most common viruses found to cause infections in infants and fExplain the principles of various diagnostic methods for detecting viruses.
- Review the treatment, prevention, and control methods of viral infections.

- Describe the process for collection, transport and analysis in the clinical laboratory, for viral detection assays.

Immunology I Unit

- Summarize the historical background of immunology.
- Explain the anatomy, development, and regulation of the immune system.
- Describe the structure and properties of immunoglobulin classes, including antibodies, antigens.
- Describe how and which cells are involved in prompting the immune response, including lymphoid and myeloid cells.
- Analyze a diagnostic assay's pitfalls both technically and in clinician ordering practices.
- Explain the theory, principle and mechanism of vaccination.

Practical Skills:

- Perform immuno-blotting assays used for virus detection.
- .
- Carry out various serological detection assays performed in a virology laboratory
- Accurately perform HIV ELISA assay.
- Accurately perform agglutination and precipitation assays in the laboratory.

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures
- Follow directions of the instructor
- Maintain punctuality during lecture and laboratory classes.
- Show general interest for virology lecture and laboratory sessions.

Virology Unit

Indicative Content:

- History of viruses and viral diseases and contribution of various discoveries in virology and viral diseases.
- Definition of terms
 - ❖ Virology Virions
 - ❖ Capsid
 - ❖ Capsomers

- General Characteristics of viruses
- Size, Morphology, Structure, Genetic composition
- DNA and RNA Viral Replication Strategies
 - Interaction between viruses and infected cells
- Mode of transmission,
- Productive interaction,
- Integrative
- Abortive
- cytopathogenic effect,
- defense mechanism
 - Introduction of viral infections:
 - Respiratory tract, GIT, CNS
 - Foetus, newborn , infants and adults
- Pathogenesis,
- epidemiology,
- diagnosis,
- prevention and control of diseases caused by RNA Viruses:
- Picornaviridae, Bunyaviridae, Filoviridae, Flaviviruses, Retroviriridae, Myxoviridae, Phleboviruses

- Heparnavirus (Hepatitis C virus),
- Hepatitis E virus, Gastroenteritis viruses
 - Pathogenesis, epidemiology, diagnosis, prevention and control of diseases caused by DNA Viruses:
 - Hepadnaviridae,
 - Herpesviridae,
 - Papovaviridae
 - polyomaviriridae,
 - Parvoviridae,
 - Rhabdoviridae
- Describe the process for collection, transport and analysis in the clinical laboratory, for viral detection assays.
- Explain the principles of various diagnostic methods for detecting viruses.
- Describe the methodology of PCR assays for detection of various viruses.
- Explain the principle of immuno-blotting for virus detection.

Immunology I Unit

Introduction to Immunology

- **Historical background of immunology, Definitions and Terminologies**
- **Innate and Adaptive Immunity**
 - **Structure and functions of cells of the Immune systems:**
 - **Lymphoid tissue**
 - **myeloid tissue**
 - **Primary immune response**
 - **Secondary immune response**
 - **Lymphocytes B cell,**
 - **T cell,**

- NK cells
- Granulocytes
- Monocytes
- Macrophages
- Dendritic CellsAntigen presenting cells
- **Antigen –Antibodies:**
- Properties of Antigens
- Properties of antibodies
- Antigen/Antibody reaction principles
- Agglutination
- , Precipitation,
- Neutralization,
- Flocculation,
- Haemolysis,
- Immunochromatography

Theory & Principles of Vaccination

- preparation of vaccines
- Serotherapy
- Immune interaction with vaccines

Practicals

- Agglutination reactions
- Precipitation reactions
- Immuno-chromatography
- Immuno-enzymatic tests/
- :
- Serological tests
- PCR

- Immuno-Blotting
- Collection, transport, and analysis of samples for the diagnosis of viral infections

8. Learning and teaching Strategies:

- Learning and teaching strategy will include lectures, demonstrations and practical exercises, self-directed learning, discussions and student presentations, group discussions, Power point presentations

9. Assessment strategy

- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation =60 %; End of module assessment Exam = 40 %

10. Assessment pattern

Component	Weight (%)
In- course assessment	20
CAT Test	40
Final assessment	40
Total	100

11. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

12. Teaching /Technical Tools/ Assistance

- Tutorial assistant

- LDC Projector
- White board and markers
- Flip charts and markers
- Immunology/Virology diagnostic instruments
- Reagents and materials
- Biosafety materials and PPE

13. Indicative resources & Reference and Recommended Readings:

1. Comprehensive Virology (volume 16) by Heinz Frankel-Conrad

12.21 Clinical Laboratory Management

Module Code:	Module N0	Course name	Subject Units:	Credits:
PQL 2522	Module 21	Clinical Laboratory Management	Clinical Laboratory Management	10

1. Pre-requisite: Phlebotomy, specimens collection and management

2. First year of presentation:2015
3. Administering Faculty: FST
4. Allocation of study and teaching hours

Module outline	Student hours	Staff hours
Lectures/Face to Face	36	36
Seminars/workshops		
Practical classes/laboratory		
Structured exercises	14	14
Set reading		
Self-directed study	30	30
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	100	10

5. Aims of the module:

- The aim of this module is to empower the students with the principles and practices of quality laboratory management
- The topic introduces the principles of quality management essentials and their application in routine clinical laboratory practice
- The topic also introduces the aspects of quality assurance and quality control for generation of quality results use efficient use of resources to achieve the organizational goals.
- This unit will provide biomedical lab scientists with the necessary skills in managing biomedical labs.

6.Learning Outcomes

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

Knowledge & Skills

- Define and explain the concepts of quality, quality service, quality performance, quality management & performance management
- Explain the principles of good leadership and management
- Explain the processes and principles of quality assurance, quality control and quality improvement in a clinical laboratory
- Describe the tasks required to ensure quality in a clinical laboratory in pre-analytical analytical and post analytical phase of the laboratory work cycles
- Explain the twelve quality essentials for management of quality assurance
- Demonstrate knowledge of quality management system essentials (QMSE)
- Explain the importance and applications of reference ranges
- Explain the principle and processes of biological specimens packaging and transportation
- Explain the various aspects of biosecurity and biosafety in a clinical laboratory
- Describe the processes and precautions of documents and records management in a clinical laboratory

- Explain the aspects of suitable laboratory setting infrastructure
- Demonstrate methods to evaluate customer satisfaction by conducting surveys
- Explain the standard requirements for laboratory accreditation, as per ISO standards and WHO SLIPTA audit checklist.

7. Indicative course content

Definitions and explanations of:

- Quality, quality service, Quality Assurance, Quality control
- Continuous quality improvement and total quality management
- Reliability, reproducibility, precision, accuracy, Validity
- Good Laboratory Practice, Standard operating procedures
- Application of standard operating procedure (SOP)
- 12 QMSE and application & 10 SLMTA modules
- International Standards Organizations (ISO)
- International Standards Organizations ISO/IEC 15189 & 17025
- Laboratory quality specimen collection and management to assure high quality laboratory results
- Sensitivity, Specificity, Predictive values, Standard Deviation, Reference intervals, Gaussian Curve Precision, Accuracy, Reproducibility, control materials, Gold standard
- Establishing reference range & verification of performance specifications, statistical applications: Mean, SD, CV, confidence limits, Westgard rules, shifts, trends, deviations, random and systematic error
- Levey-Jenning Charts/Shewhart; Evaluate standard LJ/Shewhart curves to assure high quality laboratory results; Westgard Quality Control Rules,
- Laboratory resources management: HR, Equipment, reagents, etc
- Use process control, customer satisfaction surveys, method validation and quality assessment data to enhance laboratory effectiveness
- Laboratory processes in the three laboratory work cycles: Pre -analytical, analytical & post analytical phase

- Laboratory performance quality indicators
- Internal quality control & External quality Assessment & PT
- Documentation of occurrence incidents
- Laboratory biosafety and biosecurity, management of laboratory waste, packaging of laboratory infectious & biological materials, handling of corrosive and chemicals
- Laboratory accreditation management
- Customer satisfaction survey
- Document & records control System, Patient Confidentiality, Data storage, retrieval and disposal
- Feedback provided to laboratory staff based on assessment reports

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8. Learning and teaching Strategies:

- Learning and teaching strategy will include lectures, demonstrations and practical exercises, self-directed learning, discussions and student presentations, group discussions, Power point presentations

9. Assessment strategy

- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation =60 %; End of module assessment Exam = 40 %

10. Assessment pattern

Component	Weight (%)
In- course assessment	20
CAT Test	40
Final assessment	40
Total	100

11. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.

Comments on assignment copies will be given to students.

12. Teaching /Technical Tools/ Assistance

- LDC Projector
- White board and markers
- Flip charts and markers
- Biosafety materials and PPE

13. Reference & recommended reading:

1. ISO 15189
2. Denise M. Harmening. Laboratory Management: Principles and Processes, 2nd Edition. FA Davis, 2007.
3. Laboratory Quality Management System Training Toolkit. World Health Organization, 2007. Online manual at:
http://www.who.int/ihr/training/laboratory_quality/en

12.22 Clinical Laboratory Attachment I

Module Code:	Module N0	Course name	Subject Units:	Credits:
CLA 2525	Module 22	Clinical Laboratory Attachment I	Clinical Laboratory Attachment I	30

1. **Pre-requisite: All previous modules.**
2. Administering Faculty: FST
3. 4. Allocation of study and teaching hours

Module outline	Student hours	Attachment Staff hours
Lectures/Face to Face	-	-
Seminars/workshops		
Practical classes/laboratory	250	250
Structured exercises		
Set reading		
Self-directed study	30	30
Report writing	20	20
Examination-revision and attendance		
Total	300	300

4. **Aims of the module:**

- The aim of this module is for the student to acquire initial skills in performing practical procedures in the biomedical laboratories.

5. Expected Learning Outcomes

Upon completion of this module the student will be able to:

Application of skills:

- Apply theoretical knowledge to acquire skills to
 - ❖ Obtaining suitable specimens from patient for laboratory investigations
 - ❖ phlebotomy for whole blood, serum, plasma
 - ❖ Stool, sputum, urine, swabs
 - ❖
 - ❖ Use standard operating procedures and quality control in the biomedical laboratory services
- Prepare a written account of practical skills in the clinical laboratory attachment logbook.
- Perform routine tests under supervision as a second year biomedical laboratory student in assigned areas of the clinical attachment

Attitude:

- Demonstrate good professional conduct and good laboratory practice

6. Indicative attachment content:

- The student will exercise hands on practical processes and analytical procedures at the clinical attachment site to develop skills in as requisite entry level of biomedical laboratory scientist professional.
- Identification of patients details as per request form
- Collection of blood specimens
- Detailing proper procedures for collection of suitable
 - ❖ urine

- ❖ sputum
- ❖ stool
- ❖ perform and exercise biosafety procedures
- ❖ perform sterilization and disinfection procedures
- Accurately registering patient information details in laboratory logbook

8. Learning Strategies:

- Self-directed learning: 20 hours
- Hands-on Practice in clinical attachment: 180 hours

9. Assessment Strategies:

- Continuous Assessment at site :
- Clinical Attachment logbook checklist
- Clinical laboratory attachment report

10. Assessment Weighting

Continuous Assessment	25%
Attachment Report	75%

11. Strategy for feedback and students support during module

Oral feedback will be given in class during the teaching-learning process.
 Questions are answered as they are raised.
 Comments on assignment copies will be given to students.

12. Teaching /Technical assistance

- Site supervisors

13. Indicative Resources & Recommended Reading:

1. IBMS (2004) *Criteria and Requirements for The Accreditation and Re-accreditation of BSc (Hons) degrees in Biomedical Science, UK*
2. International federation of Biomedical Lab Scientists (IFBLS) code of ethics (1992) *General assembly of delegates report*
3. International federation of Biomedical Lab Scientists (IFBLS) (1998) *Educational requirements for Medical Laboratory Sciences (1998) Report adopted by the general Assembly of delegates (GAD), Singapore.*

Additional Reading to assist in practical processes and application:

- Abdul K. and Litchman A. (2001). *Cellular and molecular immunology* (5th edition).
- Anderson C. S. and Cockayne S. (2003). *Clinical chemistry concepts and applications*. McGraw-Hill.
- Stites, D.P. *Basic and Clinical Immunology*. Lange Medical Publications
- Kessel, R. (1998). *Basic Medical Histology: The Biology of Cells, Tissues, and Organs*. Oxford University Press.
- Frankel-Conrat, H. *Comprehensive Virology* (volume 16)
- Cumings K. (1997). *Concepts of Genetics*. (5th edition).
- Hoffbrand, A. V. (1992). *Essential Haematology*. Blackwell Science Ltd.
- Gillespie S.H. and Hawskey P.M. (1994). *Medical Parasitology. A Practical Approach*. (3rd edition)
- Greenwood D.A., slack R. and Peurtheree J. (2003). *A Guide to Microbial Infections, Pathogenesis, Immunity, Laboratory Diagnosis and Control*. (6th edition).
- Leesson T. and Leesson R. (2001). *Basic Pathology*. (3rd edition)
- Katzung B.G. (2001). *Modern Epidemiology; Basic and Clinical Pharmacology*. (8th edition)
- Lewis S.M. and Bates I. (2001). *Practical Haematology* (9th edition).

- Linda Gregory, C. *Outline Review Clinical Chemistry*.
- Markell, E. K. (1999). *Markell and Voge's Medical Parasitology*.
- Mims, C. A., Playfair, J.H.L, et. al, *Medical Microbiology*. Mosby Publishers.
- *Harmening, D. M.* Modern Blood Banking and Transfusion Practices.
- Clarke, S. (2004). *Modern Medical Microbiology: The Fundamentals*. Arnold Publishers.
- Roitt I., Brostoff J., & Male D. (2001). *Immunology* (6th edition)
- Rothman J.K. & Greenland S. (1998). *Modern Epidemiology*, (2nd edition)

Level 3 (1st Semester)

12.23 Clinical Chemistry III

Module Code:	Module N0	Course name	Subject Units:	Credits:
CCH 3512	23	Clinical Chemistry III	Clinical chemistry III	10

1. Pre-requisite or requisite modules: Clinical Chemistry II
2. Administering Faculty: FST
3. 4. Allocation of study and teaching hours

Module outline	Student hours	Lecture hours
Lectures/Face to Face	36	36
Seminars/workshops		
Practical classes/laboratory	25	25
Structured exercises	5	5
Self-directed study	14	14
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	100	100

5. Aim of the module

The module aims at providing to the students deep understanding and explanation of:

- Biological nature, physiology, functions and pathophysiology of organs and systems mediated by hormones
- Clinical aspect of endocrine system and disorders associated with hormones and vitamins.

Laboratory procedures and techniques applied in the determination of hormones and vitamins.

6. Expected Learning Outcomes

Upon completion of this module the student will be able to:

Application of Knowledge:

- Define terminologies of vitamins and hormones
- Describe the processes involved in the production of hormones
- Describe the disorders of endocrine functions and their clinical manifestations.
- Describe the biological & physiological nature, functions and pathological processes of various hormones
- Describe the biological & physiological nature, functions and pathological processes of various vitamins.
- Discuss and apply the principles of laboratory procedures used in determinations of endocrine disorders and interpretation of the findings
- Discuss the effects hormonal changes in pituitary, fertility, thyroid, adrenal etc.
- Discuss the effects of hormones on the functions of the Liver, Kidney, Heart, Muscles, Stomach, etc.
- Correlate clinical Information and laboratory tests data of hormones
- Describe the type, physical & physiological characteristics of vitamins
- Explain the importance and the sources of various vitamins
- Explain the principles of laboratory analysis of various vitamins
- Apply quality assurance and quality control in analytical procedures of vitamins and hormones

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures

Follow directions of the instructor

. Indicative content:

- Overview of and the endocrine system –
- hypothalamus
- pituitary gland
- Peripheral glands:
- Thyroid hormone
- parathyroid hormones
- Adrenal gland hormones
- Ovary hormones
- Testicles hormones
- Growth hormone
- Prolactin
- Vasopressin
- Reproductive endocrinology; aspects of pregnancy & Infertility and testing
- Physiological processes and functions of various hormones

- Liver function, Renal, Gastric, pancreatic and intestinal function tests mediated by hormones,
- Tumor markers

Vitamins

- Definition
- Sources of vitamins
- Fat and water soluble vitamins
- Vitamins A, B, C, D,E ,K, Folic Acid
- Functions , clinical significance of vitamins & disorders due to lack of vitamins

- Laboratory analysis of various vitamins
- Apply quality assurance and quality control of biochemical tests

8. Learning and teaching strategy

- Lectures, Tutorials, Self-directed learning, Laboratory Practical sessions, Presentations, group discussions

9. Assessment strategy

- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation = 60 %; End of module assessment Exam = 40 %

10. Assessment pattern

Component	Weight (%)
In- course assessment	20
CAT Test	40
Final assessment	40
Total	100

11. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

12. Teaching /Technical Tools/ Assistance

- laboratory assistant
- LDC Projector
- White board and markers

- Flip charts and markers
- Clinical chemistry diagnostic instruments
- Reagents and materials
- Biosafety materials and PPE

13. Indicative resources & Recommended Reading:

1. Anderson C. S. and Cockayne S. Clinical chemistry concepts and applications; McGraw-Hill (2003).
2. Appleton & Lange's Outline Review Clinical Chemistry by Linda Gregory, C. Linda.
3. Barbra H. Estridge, Anna P. Reynolds. Basic Clinical Laboratory Techniques
4. J. F. Zilva, P. R Pannall and P.D Mayne. Clinical chemistry in diagnosis and treatment 5th edition.
5. Lecture notes in Clinical Biochemistry 6th Edition, AF. Smith, GJ. Beckett, SW. Walker, PWH. Rae
6. The physiology coloring book 2nd Edition, Kapit, Macey, Meisami.
7. Introduction to Medical Laboratory Technology 7th Edition, FJ. Baker, RE. Silverton, CJ. Palliser.
8. A manual of Lab Diagnostic Tests 5th Edition, Frances Fischbach

Further reading

1. L. Kaplan, AJ. Pesce. Clinical Chemistry: Theory, Analysis, Correlation 3rd and 5th editions.
2. NW. Tietz, WB. Saunders. Fundamentals of Clinical Chemistry 2nd edition
3. Tietz Text book of Clinical Chemistry and Molecular diagnostics
4. Levy S. Jennings ER. The use of control charts in the clinical laboratory. American Journal of Clinical Pathology

12.24 Microbiology II and Mycology

Module Code:	Module N0	Course name	Subject Units:	Credits:
MMI 3514	24	1 Microbiology II	Microbiology II	10
			Medical Mycology	10

1. **Pre-requisite or requisite modules: General microbiology, , cell biology**
2. Administering Faculty: FST
3. Allocation of study and teaching hours

Module outline	Student hours	Staff hours
Lectures	72	72
Seminars/workshops	10	10
Practical classes/laboratory	60	60
Structured exercises	5	5
Set reading	10	10
Self-directed study	23	23
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	200	200

5. Aims of the module

- This module will introduce the students to the fundamentals and understanding of food microbiology, classifications of microorganisms, spores and their role in food contamination and poisoning.

- The module will further help students apply the knowledge of medical bacteriology in the diagnosis and identification of the food poisoning microorganisms
- The student will learn the principles and concepts of food and analytical microbiology of food stuff to isolate the causes of pathogenesis, the knowledge of which will be applied in the biomedical laboratory diagnosis of food related diseases.

6. Learning Outcomes

At the end of this module student should be able to:

Knowledge

- Define food microbiology
- Recognize and describe the characteristics of important pathogens and food spoiling microorganisms.
- Describe the role and significance of intrinsic and extrinsic factors on growth and response of microorganisms on foods.
- Identify the conditions under which the important pathogens and spoilage microorganisms are commonly inactivated, killed or made harmless in foods.
- Discuss the role of biomedical laboratories in analysis and surveys of foods and beverages transmitted pathogens
- Identify ways to control microorganisms in foods.
- Describe the beneficial role of microorganisms in fermented foods and in food processing.
- Apply microbiological laboratory techniques to detect, quantify, and identify microorganisms in foods.
- Acquire, discover, and apply the theories and principles of food microbiology in practical, real-world situations and problems.
- Describe the characteristics of each group of microorganisms of medical importance; Use the knowledge for lab identification and diagnosis of the microorganisms.

- Compare and contrast the characteristics, pathogenesis and, epidemiology of food poisoning and spoilage bacteria.
- Review the factors which limit the growth of these bacteria.
- Explain the concepts of mycology
- Describe the morphologies and classification of fungi of medical importance
- Demonstrate the skills and techniques for the laboratory identification and diagnosis of fungal diseases

Application of Knowledge

- Describe and classify different groups of microorganisms responsible for food poisoning: bacteria, fungi & spores.

Application of Practical Skills

- Apply the knowledge of predictive microbiology in the analysis of food poisoning and spoilage.
- Apply all the necessary tests used in the identification of foods & beverages poisoning and spoilage.
- Perform diagnostic procedures for identification of fungi and bacteria responsible food poisoning.

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures
- Follow directions of the instructor

7. Indicative Content

Microbiology II

- Characteristics and description of food poisoning and spoilage bacteria:
 - ❖ Classification of bacteria and fungi responsible for food spoilage
 - ❖ Food, milk and water microbiology
 - ❖ Natural and spoilage flora of foods
 - ❖ Major food poisoning micro-organisms
 - ❖ Factors which favour microbial growth in foods and beverages
 - ❖ Factors which limit microbial growth in food

- Epidemiology of each species
 - ❖ Source of infection
 - ❖ Route of infection
 - ❖ Mode of infection
 - ❖ Cross infection
 - ❖ Health carriers
 - ❖ Domestic and Wild Animals
 - ❖ Mode of prevention and control

- Tests and analysis for identification of food poisoning and spoilage bacteria and fungi
 - ❖ Use predictive microbiology programs for food poisoning and spoilage organisms
 - ❖ Tests used in the Identification of Bacteria and fungi of food poisoning

Mycology

- Definition of terminologies used in Mycology

- Concepts of Mycology
- Introduction to medical mycology
- Nature and role of fungi in clinical medicine

- Classification Fungi of medical importance
- Phycomyces,
- Ascomyces,
- Basidiomycetes,
- Fungi imperfect
- Yeasts and yeast-like fungi
 - ❖ Candida
 - ❖ Cryptococcus
- Dermatophytes
 - ❖ Tineae
 - ❖ Microsporum
 - ❖ Trichophyton
 - ❖ Epidermophyton
- Dimorphic Fungi
 - ❖ Histoplasma
 - ❖ Blastomyces
 - ❖ Sporothrix
 - ❖ Coccidioides
- Rapid Growers
 - ❖ Rhizopus
 - ❖ Mucor
 - ❖ Aspergillus

- Diagnostic procedures

- ❖ Collection of specimens from skin, nails, hair, etc.
- ❖ Direct Preparations
- ❖ 30% - 10% KOH
- ❖ Staining techniques
- ❖ Germ tube evaluation

Microscopic examination

8. Assessment strategies

- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation =60 %; End of module assessment examination = 40 %

9. Assessment pattern

Component	Weight (%)
In- course assessment	20
CAT Test	40
Final assessment	40
Total	100

10. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

11. Teaching /Technical Tools/ Assistance

- Laboratory assistant
- LDC Projector

- White board and markers
- Flip charts and markers
- Microbiology diagnostic instruments
- Reagents and materials
- Biosafety materials and PPE

12. Indicative resources & Recommended Readings

1. Food Microbiology: An Introduction, 2008, Thomas J. Montville and Karl Matthews, American Society for Microbiology (ASM) Press, Washington, DC
2. Food Microbiology: Fundamentals and Frontiers, 2001, Edited by Michael P. Doyle, Larry R. Beuchat, and Thomas J. Montville, 2nd edition, American Society for Microbiology (ASM) Press, Washington, DC
3. Modern Food Microbiology. Seventh Edition. J.M. Jay. Aspen Publishers, Inc., Gaithersburg, Maryland 2005.
4. Fundamental Food Microbiology. Second Edition. Third Edition. B. Ray. CRC Press 2005.
5. Food Microbiology: An Introduction. T.J. Montville and K.R. Matthews (any edition) ASM Press, Washington, DC.

12.25 Molecular Biology I

Module Code:	Module N0	Course name	Subject Units:	Credits:
MBI 3512	25	Molecular Biology I	Molecular Biology I	10

1. Pre-requisite or requisite modules: Biochemistry, , cell biology& genetics
2. Administering Faculty: FST
3. Allocation of study and teaching hours

Module outline	Student hours	Staff hours
Lectures/Face to Face	36	36
Seminars/workshops		
Practical classes/laboratory	25	25
Structured exercises	5	10
Set reading		
Self-directed study	14	14
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	100	100

5. Aims of the module

- The aims of this module are to introduction the students to molecular biology of the cell.
- The course will provide the student with understanding of the physiological roles of the DNA & RNA in perpetuation of life as genetic components of the cell.

- This course explains the interactions between the various systems of a cell, including the interrelationship of DNA, RNA and protein synthesis.

6. Learning Outcomes

At the end of this module students should be able to:

Knowledge:

- Explain aspects of molecular biology of the human cell
- Explain the process of DNA and RNA transcription and replication.
- Explain the principles behind the manipulation of nucleic acids and proteins.
- Describe various types of gene mutation
- Explain the principle of polymerase chain reaction in molecular biology laboratory and diagnosis of viral infections

Application of Knowledge:

- Accurately apply Native and Denaturing Gel Electrophoresis.
- Accurately apply DNA isolation, Extraction and Purification techniques.
- Apply Immuno-blotting and Western Blotting, Northern as well as Southern blotting.

Practical Skills

- Accurately perform DNA isolation Extraction and Purification.
- Accurately perform the HIV Viral Load assay
- Accurately perform Native and Denaturing Gel Electrophoresis.

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures
- Follow directions of the instructor

- Display the ability to work independently.
- Conform to the code of ethics with regard to patient confidentiality.

7. Indicative content:

- Overview of Molecular Techniques
 - ❖ Southern blotting
 - ❖ Northern blotting
 - ❖ Western blotting
 - ❖ PCR
- Review of molecular biology with regard to:
- Safety practices in molecular biology laboratories
- Medicine in molecular bio-technology
- Laboratory instrumentation utilized in the molecular biology laboratory
- The arrangement of genes and chromosomes
 - Chromosome mapping and genetic cross
 - Bacterial and Viral genetic material
- DNA: The genetic material
 - Search for the genetic material
 - DNA structure
 - RNA structure
 - Transcription
 - DNA replication
 - Copying DNA into RNA
 - RNA processing
- From messenger RNA to protein.
 - The process of Translation
 - Involvement of mRNA in protein synthesis
 - DNA & RNA sequencing
 - Post translation modifications
- Mutations and mutation types.
 - Chromosomal mutations

- Gene mutations
- Mutagenic agents
- Sequences, unique amino acid sequences over mutations
- Cause of mutations and DNA repair mechanisms
- Gene expression
 - Variation in protein amounts
 - Protein production
 - Regulation of protein function
- Regulation of Gene expression
 - Regulated versus Constituent genes
 - Transcriptional regulations and Operons
 - Translational and post-translational regulations of bacterial genes
 - Regulatory Proteins affect RNA Polymerase binding and efficiency of transcription initiation
 - Other mechanisms for the regulation of Eukaryotic genes

Practicals

- Perform laboratory procedures:
 - ELISA technique
 - Precipitation reactions
 - HIV CD4 Counting by, flow cytometry
 - HIV Viral Load by PCR

8. Assessment Strategy:

Written examination (test) to assess the student's knowledge and understanding of molecular biology theory. Practical examination to assess the student's practical skills in PCR

Written assignment, the purpose of which is to help student's present topics on disorders detected by molecular techniques. Final examination.

9. Assessment Patterns

Component	Weight (%)
In-course assessment	20
CATs	40
Final assessment	40

11. Indicative resources

Recommended Reading Materials:

- Deanna Raineri. 2001. Introduction to Molecular Biology. Blackwell Science, inc
- T.A.Brown. 2001. Gene cloning and DNA analysis, an introduction. 4th ed. Blackwell Science,
- Carl Burtis, Edward Ashwood, David Bruns. Editors. 2006. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. 4th edition. Elseviers Saunders. St. Louis Missouri.

12.26 Clinical Laboratory Attachment II

Module Code:	Module N0	Course name	Subject Units:	Credits:
CLA 3516	26	Clinical laboratory Attachment II	Clinical Laboratory Attachment II	

1. Pre-requisite modules: Previous Course Modules, Clinical Laboratory Attachment I
2. First year of presentation: 2015
3. Administering Faculty: FST
4. Allocation of study and teaching hours

Module outline	Student hours	Staff hours
Lectures		
Seminars/workshops		
Practical classes/laboratory	350	350
Structured exercises		
Set reading		
Self-directed study	30	30
Report writing	20	20
Assignments-preparation and writing		
Examination-revision and attendance		
Total	400	400

5. Aims of the module:

- The aim of this module is for the student to acquire detailed skills in performing practical procedures in the biomedical laboratories.
- Use of standard operating procedures in performing analytical procedures

- Application of quality assurance and quality control in performing analytical procedures

6. Learning Outcomes

Upon completion of this module the student will be able to:

Application of skills:

- ❖ Apply theoretical knowledge to acquire
- ❖ Use standard operating procedures and quality control in the biomedical laboratory services
- Prepare a written account of practical skills in the clinical attachment logbook.
- Work with supervisors in performing analytical techniques in assigned areas of the clinical laboratory attachment

Attitude:

- Demonstrate good professional conduct and good laboratory practices

1. Indication attachment content:

- ❖ Acquire skills by performing specific analytical procedures in specific sections of the laboratory:
 - ❖ Bacteriology
 - ❖ Clinical chemistry
 - ❖ Heamatology
 - ❖ Molecular biology
 - ❖ Immunology
 - ❖ Histopathology
 - ❖ Immuno-heamatology
 - ❖ Parasitology

8. Learning Strategies:

- Self-directed learning: 40 hours
- Hands-on Practice in clinical attachment: 360 hours

9. Assessment Strategies:

- Continuous Assessment at site :
- Clinical Attachment logbook checklist
- Clinical laboratory attachment report

10. Assessment Weighting

Continuous Assessment	(25%)
Attachment Report	(75%)

11. Strategy for feedback and students support during module

12. Teaching /Technical assistance

- Site supervisors

Level 4 (2nd semester)

12.27 Module: Medical Parasitology III

Module Code:	Module N0	Course name	Subject Units:	Credits:
MPE 4522	Module 27	Medical Parasitology III	Medical Parasitology III	10

1. Pre-requisite modules: Medical parasitology II
2. Administering Faculty: FST
3. Allocation of study and teaching hours

Module outline	Student hours	Staff hours
Lectures/Face to Face	36	36
Seminars/workshops		
Practical classes/laboratory	25	25
Structured exercises	5	10
Set reading		
Self-directed study	14	14
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	100	100

5. Aims of the module

- The aim of this module is to empower the students with deep understanding the principles and techniques for the diagnosis of blood and tissue parasites and intestinal parasite of medical importance The course will equip the students with the control methods of diseases caused by these parasites.

- The students will learn the skills to independently analyse a given sample in the laboratory.

6. Expected Learning Outcomes

At the end of this module students will be able to:

Knowledge

- Review the detailed life cycle,
- pathology,
- Epidemiology of blood , tissue , liver and intestinal parasites.
- Review the, control and preventive measures of the parasitic diseases
- Demonstrate skills in collection and preservation of specimens for the diagnosis of parasites
- Demonstrate skills and techniques in diagnosis of blood and tissue parasites

Application of Knowledge

- Apply the knowledge of parasitology in understanding the diseases caused by blood and tissue parasites.

Practical Skills

- Examine and microscopically identify blood ,tissue parasites and intestinal parasites.

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures
- Follow directions of the instructor

2. Indicative content:

- Review detailed the life cycle of parasites

Pathology,

Identification features

Epidemiology of the diseases caused by blood, tissue liver and intestinal parasites.

- Review the control and preventive measures of the parasitic diseases
- Describe in detail the blood , tissue , liver, intestinal parasites of medical importance;
-
- Geographical & epidemiology distribution,
Practicals
- Demonstrate skills and techniques in diagnosis of blood and tissue parasites
- Protozoa
- Helmenths
- Nematodes
- Cestodes
- Trematodes
- Liver flukes
- Tissue parasites

8. Assessment strategies

- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation = 60 %; End of module assessment examination = 40 %

9. Assessment pattern

Component	Weight (%)
In- course assessment	20
CAT Test	40
Final assessment	40
Total	100

10. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

11. Teaching /Technical Tools/ Assistance

- Tutorial assistant
- LDC Projector
- White board and markers
- Flip charts and markers
- Parasitology diagnostic instruments
- Reagents and materials
- Biosafety materials and PPE

11. Indicative resources & Recommended Reading:

1. Gillespie S.H. and Hawskey P.M. (1994). *Medical Parasitology. A Practical Approach.* (3rd e)

12.28 Histotechnology and Histopathology

Code: HIH 4523	Module 28: Histotechnology and Histopathology	Units: Histotechnology and Histopathology	Credits: 15
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1. Pre-requisite: Anatomy, physiology, cell biology & histology
2. Administering Faculty: FST
3. Allocation of study and teaching hours

Module outline	Student hours	Staff hours
Lectures/Face to Face	54	54
Seminars/workshops		
Practical classes/laboratory	40	40
Structured exercises	10	10
Set reading		
Self-directed study	26	26
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	150	150

5. Aims of the module:

- The module introduces students to histotechniques of staining tissue and cell slide preparations for microscopic identification The course also introduces students to histochemistry techniques and application in the diagnosis of tissue diseases
- The student will be able to describe hemodynamic disturbances, understand terminologies associated with malignant conditions, and describe special staining procedures as listed in module objectives.

6. Learning Outcomes:

- Describe different appearance and characteristics of different tissue and organ cells Prepare different human cells , tissues and organs specimens for fixation/examination
- Prepare different histology stains and reagents
- Perform section cutting on the microtome
- Carry out manual /automated tissue processing; observe and describe automatic tissue processing, embedding, staining and mounting
- Perform section staining with H&E and other special staining techniques
- Examine stained section for quality results
- Perform microscopic recognition of different normal cells
- Select and Perform special stain procedures, which will demonstrate well the condition of the tissue (when not evident on H&E-stained sections)
- Recognize in microscopic sections, malignant conditions
- Recognize lesions due to inflammatory processes and recognize microorganisms in the tissue
- Demonstrate elementary cellular and tissue lesions and the main lesions in metabolic disorders

Knowledge

- histopathology; autopsy; biopsy, fine needle aspirates; autolysis; Putrefaction
- Post-Mortem changes in tissues and cells: putrefaction; autolysis Biohazard safety issues and precautions
- Description of various fixatives: properties, mode of action and staining effect on tissues and cells, nucleic and cytoplasmic fixatives.
- Apply the correct stains to enhance particular cellular and tissue structures for examination.

- Determine the features of common diseases under the microscope using the systems described above.
- Describe elementary cellular and tissue lesions
- Describe main lesions in metabolic disorders
- Recognize lesions due to inflammatory processes and recognize microorganisms in tissue
- Describe hemodynamic disturbances
- Define and use terminology associated with malignant conditions
- Describe special staining procedures

Practical Skills

- Prepare specimens for fixation/examination
 - ❖ Fresh specimens; teased; squashes smears
 - ❖ Frozen sections
 - ❖ Gross specimens
- Dissection and description of gross specimens for processing
- Prepare different human cells , tissues and organs specimens for fixation/examination
- Prepare different histology stains and reagents
- Stains and reagents:
- Fixatives; Dehydration reagents; Clearing reagents; Decalcifying reagents;
- Carry out manual tissue processing; observe and describe automatic tissue processing
- Perform section cutting on the microtome
- Carry out manual /automated tissue processing; observe and describe automatic tissue processing, embedding, staining and mounting
- Perform section staining with H&E and other special staining techniques
- Examine stained section for quality results
- Perform microscopic evaluation of tissue, with recognition of abnormality, lesion, or present disease

- Select the special stain procedure which will demonstrate well the condition of the tissue (when not evident on H & E-stained sections)
- Perform special stain procedures
- Biohazard and chemical safety issues and precautions & Chemical safety issues and precautions

3. Indicative contents

- Definitions of histotechnology and histopathology terminologies
- Tissue study methods;
 - ❖ the epithelia :
 - ❖ the skin,
 - ❖ glands;
 - ❖ the connective tissue
 - ❖ the blood and the defense system
 - ❖ the nerve tissues
 - ❖ the muscular tissues
 - ❖ skeletal
 - ❖ Cardiac , smooth muscle
 - ❖ heart,
 - ❖ blood and lymphatic vessels;
 - ❖ lymphoid and myeloid organs
 - ❖ ; serous membranes;
 - ❖ skin organ;
 - ❖ alimentary canal
 - ❖ : digestive tract and adjacent structures
 - ❖ ; respiratory apparatus
 - ❖ : respiratory airways and pulmonary parenchyma;
- The kidney and urinary system;
- endocrine glands;
- genital apparatus;

- eye and its annexes;
- Principle and use of light microscopy and electron microscopy.
- Tissue section cutting and processing up to staining
- Histotechnique in production of stained sections of tissues on the slides.
- Microscopic identification of normal tissue organs
- This module will also aim to help the student to be able to describe elementary cell and tissue lesions,
- Apply special histological techniques
- Histopathology – diseased tissue conditions
- Histochemistry techniques for the detection of:
 - ❖ Glycogen PAS
 - ❖ Lipid needs cryostat to perform
 - ❖ Mucin PAS or Alcian blue
 - ❖ Other special stains (Trichrome of Masson, Foot, Grocott methenamine silver, Perls Iron, Ziehl-Neelsen, Giemsa, Warthin Starry, Orcein, etc)
- Immuno-Histochemistry techniques
- Immunofluorescent (IF) procedures

Manual & Automatic tissue Processing:

- Fixation; Dehydration; Clearing; Impregnation;
- Embedding and embedding center
- Histokinette tissue processor: principle of function; advantages and disadvantages; construction
- Describe problems encountered with improper tissue processing (to include temperature variations) and solutions
- Embedding center components, temperatures, usage
- Orientation of tissue in blocks
- Techniques used in embedding
- Preparing blocks for sectioning

Practice section cutting

- Principle of the rotary microtome
- Knives and angles of cutting
- Steps of procedure
- Sharps safety issues and precautions
- Haematoxylin and Eosin
- Special stain procedures
- Mounting – aqueous and resinous
- Recognize improper staining and problem-solve staining problems
- Chemical safety issues and precautions
- Examine stained section
- Examination of stained section to assure technical quality:
- Nuclear staining, Cytoplasm staining, Cellular structures, Special stain procedures
- Recognize appropriate staining results of all types of stains

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures
- Follow directions of the instructor

Histotechnology unit

- Normal organ microscopic anatomy
- Fixation, decalcification, processing and embedding of tissue specimens
- Microtomy of wax-embedded tissue specimens
- Routine (H&E) staining
- Introduction to special staining techniques
- Papanicolau (pap smear) cytotechnique staining

- Special histological techniques
- Examination of stained section to assure technical quality:
- Results of special stain procedures
- Histopathology – diseased tissue conditions
- Histochemistry techniques for the detection of:
- Glycogen PAS, Lipid needs cryostat to perform
- Mucin PAS or Alcian blue, section staining:, special stain procedures
- Mounting – aqueous and resinous
- Other special stains (Trichrome of Masson, Foot, Grocott methenamine silver, Perls Iron, Ziehl-Neelsen, Giemsa, Warthin Starry, Orcein, etc)
- Immuno-Histochemistry techniques
- Immunofluorescent (IF) procedures

8. Assessment strategies

- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation =60 %; End of module assessment examination = 40 %

9. Assessment pattern

Component	Weight (%)
In- course assessment	20
CAT Test	40
Final assessment	40
Total	100

10. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.

- Comments on assignment copies will be given to students.

11. Teaching /Technical Tools/ Assistance

- LDC Projector
- White board and markers
- Flip charts and markers
- Histopathology diagnostic instruments
- Reagents and materials
- Biosafety materials and PPE

12. Indicative resources & Recommended Reading:

1. Histotechnology: A Self-Instructional Text by Carson Wheaters Tissue atlas and text (or other similar text) Kessel, R. (1998). *Basic Medical Histology: The Biology of Cells, Tissues, and Organs*. Oxford University Press.
2. Burkitt, H. G., Stevens, A., Lowe, J. S., Young, B. (2009). *Wheaters basic histopathology: a colour atlas and text*. (5th ed.). New York, USA: Churchill Livingstone.
3. Gartner, L. P., & Hiatt, J. L. (2009). *Color atlas of histology* (5th ed.). Philadelphia, USA: Lippincott William & Wilkins.
4. Mescher, A. (2009). *Junqueira's basic histology*. (12th ed.). New York, USA: McGraw-Hill Medical.
5. Ross, M. H., & Pawlina, W. (2010). *Histology: A text and atlas* (6th ed.). Philadelphia, USA: Lippincott William & Wilkins.
6. Young, B., Lowe, J. S., Stevens, A., Heath, J. W., Deakin, P. J., Woodford, P., & O'Dowd, G. (2006). *Wheater's functional histology: A text and colour atlas* (5th ed.). Oxford, UK: Churchill Livingstone.

12.29 Research Methodology

Module Code:	Module N0	Course name	Subject Units:	Credits:
REM 3523	29	Research Methodology	Research Methodology	10

1. **Pre-requisite or requisite modules: Biostatistics, Computer skills,**
2. Administering Faculty: FST
3. Allocation of study and teaching hours

Module outline	Student hours	Lecturer hours
Lectures	36	36
Seminars/workshops	-	-
Practical classes/laboratory	19	19
Structured exercises	10	10
Set reading	5	5
Self-directed study	10	10
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total		

5. Aim of the module

- This course is intended to introduce and empower the students with the various research methods and the stages involved in preparing a research proposal.
- The course will empower the students with ability to understand and design health research study using appropriate research and analytical techniques.

- The course introduces to the students to quantitative statistical analysis and to demonstrate ways in which such methods of measurement and analysis can be employed in the practice of medical services.

6. Learning outcomes

By the end of this course a student should be able to

- Describe the principles of research methodology
- Apply the principles of research methodology and present a research proposal.
- Apply research data to solve medical related problems

Application of Knowledge

- Carry out medical and biomedical research
- To explain the meaning of scientific research as applied to health sector

Skills

- Conceptualize a research proposal and methods
- Conduct a relevant literature review and search
- Apply statistical methods in collecting and analyzing research data

Attitude:

- Apply ethical principles in conducting health research
- Apply teamwork spirit principles in conducting health research
- Correctly analyses and interpret research data

7. Indicative content

- Research problem identification and formulation into a research statement

- Literature review and citation methods;
- Hypothesis generation, Research designs;
- Formulation of a researchable question
- Identification and evaluation of a research problem
- Developing a conceptual framework
- Steps of research process
- Study design in qualitative versus quantitative research
- Comparisons: Quantitative versus qualitative research
- Principles of research methodology
- Research methods, research protocol development,
- Preparation and presentation of a research proposal.
- Introduction to course, terminology and scales of measurement
- Definitions of data, population, sample and variable;
- Scales of measurement (types of data; Descriptive and inferential analyses and their relevancy.
- Ethical principles in health related research
- Data collection in quantitative versus qualitative research
- Development of a research protocol (proposal)
- Data collection , analysis and presentations,
- Intervention research methodologies;
- Research Budgeting and application;
- Research ethical issues

8. Learning and teaching strategy

- Lecturing, demonstration, deductive, inductive, interrogative, group work and group discussion, class presentation, power point presentation, self-documentation methods, Role plays, Brain storming, Pilot studies will be us

9. Assessment strategy

- This comprises of continuous assessment tests, which will include group work with presentation, personal written test, practical test and final examination.

10. Assessment pattern

Component	Weight (%)
Assignments	20
CAT	40
Final assessment	40
Total	100

11. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process. Questions are answered as they are raised.
- Comments will be given to students' copies to improve their performance.

12. Teaching /Technical assistance

- Laptop computer
- LDC Projector
- White board and markers
- Flip charts and markers

13. Indicative Resources & recommended reading

1. Ranjit K. (1996). Research Methodology: A step-by-step Guide for Beginners. Sage Publications. London
2. World Medical Association. Declaration of Helsinki: Human experimentation. World medical Asociation, Helsinki 1964 (modified 1975).

3. CIOMS. International Ethical Guidelines for Biomedical Research Involving Human Subjects. CIOMS. Geneva.
4. Corlien M. Varkevisser, Indra Pathmanathan, Ann Brownlee (2003). *Designing and Conducting Health Systems Research Projects Volume I: Proposal Development and Fieldwork*. WHO/IDRC. http://www.idrc.ca/en/ev-33011-201-1-DO_TOPIC.html
5. Corlien M. Varkevisser, Indra Pathmanathan, Ann Brownlee (2003). *Designing and Conducting Health Systems Research Projects Volume Volume II: Data analysis and report writing* WHO/IDR. http://www.idrc.ca/en/ev-33013-201-1-DO_TOPIC.html

12.30 Immunology II

Module Code:	Module N0	Course name	Subject Units:	Credits:
AIM 4522	30	Immunology II	Immunology II	10

1. Pre-requisite or requisite modules: Immunology I
2. Administering Faculty: FST
3. Allocation of study and teaching hours

Module outline	Student hours	Staff hours
Lectures/Face to Face	30	30
Seminars/workshops	-	-
Practical classes/laboratory	25	25
Structured exercises	5	5
Set reading	-	-
Self-directed study	20	20
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	100	100

4. Aims of the module

- This module aims at equipping the students with deep understanding of the major components of the human immune system
- The module also provides student with the background immunologic disorders, laboratory assays and interpretations of results.

5. Learning Outcomes

At the end of this module students should be able to:

Knowledge:

- Explain the immune disorders and regulation Describe how monoclonal antibodies are commercially produced for laboratory use.
- Explain how flow cytometry is used to diagnose lymphoma and leukemia and other infectious diseases.
- Describe the role and mechanism adaptive immune response
- Explain the basic functions of each part of the fluorescent microscope system and application in immunofluorescence diagnosis.
- Explain the principle of the indirect IFA.
- Compare the direct IFA technique with the indirect IFA technique.

Application of Knowledge:

- Analyze diagnostic assays limitations, Describe the theory and principle of diagnostic Flow Cytometry.
- Describe the sources of errors of the ELISA tests antibodies
- Explain procedure for performing CD4 T-Cell count and interpretation of.
- Explain the clinical indications and application of Western blot assay.
- Describe the serologic profile of HIV infection.
- Describe the laboratory tests involved in the evaluation of immunodeficiency and the proper sequence of said testing.

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures
- Follow directions of the instructor

7. Indicative Content:

The Immune Responses and Complexes

- Hypersensitivity: types I, II, III, IV, (immediate, delayed)
- MHC molecules
- Co-operation between T and B lymphocytes and their regulation
- Common Immuno-pathological disorders

The Complement system

- Definition of complement
- Components and their functions
- Complement pathways and overview of assays for complement deficiency.

Immuno-deficiencies

- Inherent
- Acquired- i.e. HIV/CD4

Production and use of antibodies- Immunoassays

- Anti-sera
- Monoclonal antibodies
- Immunoprecipitation
- Immunocytochemistry
- IFA-Indirect Fluorescent Antibodies (ANA, FTA, Other)
- Flow Cytometry (CD4, CD3, CD8) Leukemia, Lymphoma CD Markers

Immune reactions and immunoassays

- Cytotoxicity
- Immune regulatory mechanism
- Immune response to disease
- ELISA
- Western blotting
- Immuno-blotting
- Antibody mediated complement dependent cytotoxicity assay
- ELISA (i.e. HIV)

Overview of Cellular Techniques

- Cell proliferation (CTL) assay
- Plaque forming cell (PFC) assay
- NTB test

Practical Skills:

- Perform an ELISA or Enzyme immunoassay according to standard operating procedure (SOP) for HIV, and reviewing hepatitis assays.
- Following the standard operating procedure, accurately perform and quantitate the number of CD4 T-cell lymphocytes by flow cytometry.
- Perform western blot techniques

8. Assessment Strategy:

- Written examination (test) to assess the student's knowledge and understanding of immunology theory.
- Practical examination to assess the student's practical skills in the diagnosis of immunological disorders or misregulation, such as HIV.
- Written assignment, the purpose of which is to help student's present topics on immunologic disorders.
- Final examination.

9. Assessment Patterns (Methods & Weightings)

Component	Weight (%)
In-course assessment	20
CATs	40
Final assessment	40

10. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

11. Teaching /Technical assistance

- LDC Projector
- White board and markers
- Flip charts and markers
- Immunohaematology diagnostic instruments
- Reagents and materials
- Biosafety materials and PPE

10. Indicative resources

- Abdul K. and Litchman A. (2001). *Cellular and molecular immunology* (5th edition).
- Stites, D.P. *Basic and Clinical Immunology*. Lange Medical Publications

12.31 Hematology III and Immuno-haematology II

Module Code:	Module N0	Course name	Subject Units:	Credits:
HBT 4523	Module 31	Hematology III and Immuno- haematology II	1. Hematology III	5
			2. Immuno-hematology II	10

1. Pre-requisite or requisite modules: Haematology II & Immuno-haematology I
2. Administering Faculty: FST
3. Allocation of study and teaching hours

Module Outline	Student hours	Staff hours
Lectures	54	54
Seminars/workshops	-	-
Practical classes/laboratory	40	40
Structured exercises	5	5
Set reading	-	-
Self-directed study	31	31
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	150	150

4. Aims of the module

- The aim of this module is to equip the students with understanding of the science behind the medical event and the importance in the correct lab diagnosis of leukocyte disorders including:
- Leukaemia Myelofibrosis Multiple myeloma Polycythaemia Bone marrow which is critical for the proper management of these disorders.
- The aim of the second part of Blood Transfusion Sciences is to impart composite training in fundamental and laboratory diagnostic techniques of blood Transfusion sciences and to impart training and stimulate interest in research in the field of blood Transfusion sciences and provide students with skills related to practices of transfusion medicine.

5. Learning Outcomes

By the end of this module, students should be able to:

Knowledge

- Discuss leukocyte disorders including diagnosis and treatment.
- Evaluate and summarize laboratory data related to the diagnostics of leukocyte disorders.
- Define Leukemia, myelodysplastic syndromes, and lymphomas
- Compare and contrast acute and chronic leukemia.
- Compare and contrast acute myeloid and acute Lymphocytic leukemia.
- List and describe each of the FAB subtypes of acute Lymphocytic and myeloid leukemia.
- Interpret characteristic morphology and cytochemical staining patterns for each of the FAB subtypes of acute myeloid leukemia and Lymphocytic leukemia.
- List the criteria for immunologic classification of acute Lymphocytic leukemia including early pre-B, pre-B, B-cell, and T-Cell Leukemia.
- Describe the role of cytogenetic analysis of newly diagnosed leukemia.
- Describe tests that may be needed to provide a differential diagnosis for lymphomas.

- Describe the prognosis and treatment options for Hodgkin's lymphoma and the more common categories of non-Hodgkin's lymphoma.
- Explain the principles and techniques involved in blood transfusion.
- Describe the potential incidents involved in transfusion.
- Describe infections which can be transmitted through transfusion.
- Explain the principles of blood collection and blood processing (preparation of blood components) and preservation.
- Discuss the main indications of blood transfusion and the transport of blood from blood collection site to blood banks and from blood banks to hospitals.
- Describe immunization induced by transfusion, the qualitative and quantitative aspects of blood incompatibility, the main transfusion accidents and their management by the blood transfusion centres.

Application of Knowledge

- Given a description of the cellularity of a lymph node biopsy, propose the most likely classification Hodgkin's and non-Hodgkin's Lymphoma

Practical Skills

- Perform all tests related with the fetomaternal immunization surveillance and the preparation of blood components.

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures
- Follow directions of the instructor

6. Indicative Content:

The genetics of Haematological Malignancies

- Introduction & definitions of key terms
- Leukemias & causes :
- Inherited and acquired predisposition to Leukaemia and Lymphoma

- Genetic abnormalities associated with haematological malignancies and translocations associated with haematological malignancy
-
- Value of Genetic Markers in management of haematological malignancy
- Leukocytes – benign disorders, diagnosis and treatments

Leukaemia

- Classification
- Stages/types
- Diagnosis
- Treatment

Malignant Lymphomas

- Introduction
- Hodgkin's Lymphoma
- Non-Hodgkin Lymphoma
- Clinical features of Non-Hodgkin's Lymphoma
- Specific subtypes of Non-Hodgkin's lymphoma
- T-cell Lymphoma

Multiple Myeloma and Related disorders

- Introduction
- Clinical features
- Diagnosis
- Treatment

Myeloproliferative disorders

- Introduction
- Classification
- Diagnosis

- Treatment

Blood Transfusion Sciences Introduction to immunohaematology II

- Blood Transfusion history
- Donor recruitment procedures
- Donor selection;
- reasons and criteria for selection

Blood Collection

- The technique of giving blood
- Plasmapheresis and aphaeresis
- Handling of blood units
- Preservation principles

Blood Units Fractionation

- Scheme of blood fractionation
- Preparation of packed cells and FFP
- Preparation of platelets
- Preparation of leukocytes
- Preparation of frozen red cells
- Preparation of stable components
- Conditions, reasons and effects of blood preservation

Transfusion indications

- Indications of red blood cells
- Indications of FFP
- Indications of platelets
- Indications of leukocytes
- Indications of stable components

Anti-erythrocyte immunization

- Introduction
- Immune response in Blood Transfusion Sciences
- Immunization effects

Anti-erythrocyte incompatibility

- Introduction
- Qualitative aspects of red blood cell hemolysis
- Antibody identification using panels

Red cell transfusion

- Red cell survival after transfusion
- Transfusion and anemia
- Transfusion in adults
- Transfusion in paediatrics

Transfusion incidents

- Haemolytic incidents
- Immunologic cytopenia
- Non-haemolytic incidents
- Plasma protein related incidents
- Other non Immunologic incidents
- Bacteriologic contamination

Haemolytic disease of the New-born (HDN)

- Introduction
- Foeto-maternal immunization
- Passive transfer of antibody to foetus
- Clinical aspects of HDN
- Prevention and diagnosis of HDN

- HDN related to non anti-D antibodies

Transfusion Transmitted Infections

8. Assessment Strategies:

1. Partial examinations will test the student's comprehension of module content.
2. Practical examinations will assess the student's ability to perform the various laboratory diagnostic procedures
3. Seminars will allow the student's to facilitate their own learning, by researching and presenting various topics.
4. Final examination

9. Assessment Pattern:

Component	Weight (%)
In-course assessment	20
CATs	40
Final assessment	40

10. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

11. Teaching /Technical Tools/ Assistance

- Tutorial assistant
- LDC Projector
- White board and markers
- Flip charts and markers
- Immunohaematology diagnostic instruments
- Reagents and materials
- Biosafety materials and PPE

12. Indicative resources

Recommended Readings:

- Hoffbrand, A. V. *Essential Haematology*. Blackwell Science Ltd., 1992.
- Haematology by Gavin Knight, Andrew Blann Oxford University Press, Aug 19, 2010
- District Laboratory Practice in Tropical Countries, Part 2 by Monica Cheesbrough, Cambridge University Press, Mar 2, 2006
- American Association of Blood Banks : Technical Manual, 14th edition, AABB Press, Bethesda, 2003
- PL Mollison, CP Engelfriet, Marcela Contrelas : Blood Transfusion in Clinical Medicine, 9th edition, 1993
- American Association of Blood Banks: Transfusion Therapy, Clinical Principles and Practice, AABB Press, 2nd edition, Bethesda, 2005
- American Association of Blood Banks : Transfusion Reactions 2nd edition, AABB Press, Bethesda, 2001
- American Association of Blood Banks : Practical Guide to Blood Transfusion, AABB Press, Bethesda, 2001
- European Commission : Safe Blood in Developing Countries, Principles and organisation, 1995
- Blood Banking and Transfusion Medicine: Basic Principles & Practice by Christopher D. Hillyer Elsevier Health Sciences, 2007

Level 5 (1st semester)

12.32 Molecular Biology II

Module Code:	Module N0	Course name	Subject Units:	Credits:
MBI 5512	32	Molecular Biology II	Molecular Biology II	10

1. **Pre-requisite or requisite modules:** Medical Molecular biology I
2. **Administering Faculty:** FST
3. **Allocation of study and teaching hours**

Module outline	Student hours	Lecturer hours
Lectures/Face to Face	36	36
Seminars/workshops	5	5
Practical classes/laboratory		
Structured exercises	10	10
Set reading		
Self-directed study	29	29
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	100	100

4. Aims of the module

- To understand and apply the principles of recombinant DNA technology and gene Manipulation in clinical and laboratory medicine
- Learn the application of knowledge in DNA analysis and Disease Diagnosis.

5. Learning Outcomes

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

Knowledge:

- Explain the importance of DNA manipulation in cloning.
- Describe the uses of recombinant DNA in molecular biology.
- Explain the uses of nucleic acid probes and primers in molecular biology
- Explain PCR and its applications in clinical diagnosis.

Application of knowledge:

- Correlate results of recombinant DNA and PCR techniques in diagnosis of specific diseases.

Attitude:

- Demonstrate good professional conduct in molecular biology laboratory

6. Indicative content:

- Preparation of DNA Fragments for Cloning
- RNA directed DNA synthesis
- Cutting of DNA by Restriction Endo-nucleases
- Legation of DNA with Vectors
- Cloning Vectors for Prokaryotes
- Cloning Vectors for Eukaryotes
- Legation of DNA Fragments
- Gene Libraries
- Transformation and Expression of Recombinant DNA
- Transformation and Expression of recombinant DNA
- Expression of foreign DNA in host cells
- Selection of Recombinant DNA in host cells

- Introduction
- Types of recombinant DNA selection
- Uses of Nucleic Acid Probes and Primers
- Blotting techniques
- DNA sequencing
- Chemical synthesis of DNA
- In vitro mutagenesis
- Labeling of DNA fragments
- Polymerase Chain Reaction(PCR)
- Diagnostic application of PCR and blotting techniques
- Gene Cloning in Eukaryotes
- Production of recombinant protein by eukaryotic cells
- Production of recombinant drugs
- Gene therapy
- Mutation Analysis (in Eukaryotes)
- Techniques for mutation screening
- Application of mutation detection strategies
- Developments and recent advances in Molecular Biotechnology;
- PCR expression systems;
- Biological Inhibitors and Preservatives;
- Relevant enzyme assays;
- Review of relevant Tissue culture practices;
- Relevant buffers and reagents
- The creation of trans genetic laboratory animals

Practicals

- Perform PCR techniques
- Perform DNA Recombination
- Perform DNA sequencing

7. Learning and teaching Strategies:

- Learning and teaching strategy will include lectures, demonstrations and practical exercises, self-directed learning, discussions and student presentations, group discussions, Power point presentations

8. Assessment strategies

- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation =60 %; End of module assessment examination = 40 %

9. Assessment pattern

Component	Weight (%)
In- course assessment	20
CAT Test	40
Final assessment	40
Total	100

10. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

11. Teaching /Technical Tools/ Assistance

- Tutorial assistant
- LDC Projector
- White board and markers
- Flip charts and markers
- Immunohaematology diagnostic instruments
- Reagents and materials
- Biosafety materials and PPE

12. Indicative resources & Recommended Reading:

1. National Center for BioInformatics Online Book. Molecular Biology of the Cell. <http://www.ncbi.nlm.nih.gov/>
2. <http://www.ncbi.nlm.nih.gov/sites/entrez?db=books&cmd=Search&term=From%20RNA%20to%20Protein%20AND%20mboc4%5Bbook%5D&doptcmdl=TOCView&log%24=booksrch&bname=mboc4> Retrieved 5-3-2009.
3. Bickle T, Krüger D (1993). "Biology of DNA restriction". *Microbiol Rev* 57 (2): 434–50. PMID 8336674. Retrieved on 2009-03-01
4. <http://www.pubmedcentral.nih.gov/picrender.fcgi?artid=372918&blobtype=pdf>
5. Alberts, Bruce; Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walters (2002). *Molecular Biology of the Cell; Fourth Edition*. New York and London: Garland Science. ISBN 0-8153-3218-1. Retrieved on 2009-03-01
6. <http://www.ncbi.nlm.nih.gov/books/bv.fcgi?call=bv.View..ShowTOC&rid=mboc4.TOC&depth=2>
7. Kovacs B, Maus M, Riley J, Derimanov G, Koretzky G, June C, Finkel T (2002). "Human CD8+ T cells do not require the polarization of lipid rafts for activation

- and proliferation". *Proc Natl Acad Sci U S A* 99 (23): 15006–11.
doi:10.1073/pnas.232058599. PMID 12419850. Retrieved on 2009-03-01
8. <http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed&uid=12419850&cmd=showdetailview>
 9. An easy and efficient procedure for the isolation of pure dna restriction fragments from agarose gels. A.m. ledeboer, J. Hille and R.A. Schilperoort, *Biochimica et Biophysica Acta*, 520 (1978) 498—504.
 10. University of Utah Virtual DNA lab exercise:
 11. <http://learn.genetics.utah.edu/content/labs/extraction/> Retrieved 07-03-2009.

12.33 Bacteriology III

Module Code:	Module N0	Course name	Subject Units:	Credits
MMI 5512	33	Bacteriolog III	Bacteriology III	10

1. Pre-requisite or requisite modules: Bacteriology II
2. Administering Faculty: FST
3. Allocation of study and teaching hours

Module outline	Student hours	Lecturer hours
Lectures/Face to Face	36	36
Seminars/workshops	5	5
Practical classes/laboratory		
Structured exercises	10	10
Set reading		
Self-directed study	29	29
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	100	100

5. Aims of the module

- The aim of this module is to help students to apply the systematic bacteriology in biomedical laboratory, diagnosis, treatment and research.
- The student will understand principles of microbial diagnosis and treatment of systemic, superficial and acquired bacterial infections.

5. Learning Outcomes

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

Knowledge:

- Discuss the various bacterial infections in relation to physiology of the human body.
- Review the bacterial diseases of nosocomial, respiratory, infective endocarditis, septicemia, soft tissue and borne infections.
- Discuss the principles of microbial diagnosis and treatment of systemic, superficial and acquired bacterial infections.

Practical Skills:

- Demonstrate understanding of systematic bacteriology for the diagnosis of various diseases
- Demonstrate understanding of bacterial serotyping and identification
- Demonstrate understanding of bacteria analytical profile index for complete identification and be able to interpret the results
- Demonstrate understanding differential bacteria antibiotic susceptibility tests for gram positive and negative
- Be able to Interpret antibiotic susceptibility results
- Be able to correlate causes of systemic and other related bacterial infections with bacteriology laboratory results.

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures
- Follow directions of the instructor

6. Indicative content:

Diagnosis of various infectious agents in relation to:

- Infections of the body systems in general and the Central Nervous System, in particular:
- Respiratory infections
- Food borne diseases
- Nosocomial infections (Infective endocarditis and septicaemia)
- Skin, Soft tissue and Borne Infections
- Microbial Genetics and resistance to antibiotics
- Antibiotic susceptibility tests
- Anti-Microbial Therapy
- Host-Microbe relationship and Disease processes

Practicals

- Perform systematic bacteriology for the diagnosis of various diseases
- Perform bacterial serotyping and identification
- Perform bacteria analytical profile index (API) for complete identification and interpret the results
- Perform bacteria antibiotic susceptibility tests for gram positive and negative as per WHO standards/recommendations
- Interpret antibiotic susceptibility results
- Correlate causes of systemic and other related bacterial infections with bacteriology laboratory results.

7. Learning and teaching Strategies:

- Learning and teaching strategy will include lectures, demonstrations and practical exercises, self-directed learning, discussions and student presentations, group discussions, Power point presentations

8. Assessment strategies

- Continuous assessment tests (CAT): Assignments, progress tests, practical activities evaluation, student presentation = 60 %; End of module assessment examination = 40 %

9. Assessment pattern

Component	Weight (%)
In- course assessment	20
CAT Test	40
Final assessment	40
Total	100

11. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students.

12. Teaching /Technical Tools/ Assistance

- Laboratory assistant
- LDC Projector

- White board and markers
- Flip charts and markers
- Microbiology diagnostic instruments
- Reagents and materials
- Biosafety materials and PPE

13. Indicative resources & Recommended Reading:

1. Pelczar Jr. M.J. Chan. E.C.S and Kreig. N.R (2006). "Microbiology"- 5th Edition
Mc Graw Hill Inc. New York.
2. David, B.D., Delbecco,. R., Eisen, H.N and Ginsburg, H.S (1990) "Microbiology"
5th Edition. Harper & Row, New York.
3. Lansing M. Prescott., John. P. Harley., Donald A, Klein, "Microbiology"-Mc
Graw Hill Inc. New York.
4. Robert F.Boyd., "General Microbiology" 2nd **edition.**, Times MIRROR/Moshy
College Publishing Virginia.
5. Greenwood D.A., slack R. and Peurtheree J. (2003). *A Guide to Microbial
Infections, Pathogenesis, Immunity, Laboratory Diagnosis and Control.* (6th
edition).

12.34 Integrated Pathophysiology

Module Code:	Module N0	Course name	Subject Units	Credits:
IPP 5512	34	Integrated Pathophysiology	1. Medical Semiology	10
			2. Integrated Pathophysiology	

1. **Pre-requisite or requisite modules: Anatomy, Physiology, all core modules**
2. **Administering Faculty: FST**
3. **Allocation of study and teaching hours**

	Student hours	Lecturer hours
Module outline		
Lectures/Face to Face	36	36
Seminars/workshops	5	5
Practical classes/laboratory		
Structured exercises	10	10
Set reading		
Self-directed study	29	29
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	100	100

4. Aims of the module

- This module aims at providing students with relevant integrated knowledge, understanding of integrated relevance of laboratory diagnosis results and clinical the diagnosis of disease.
- the module also provides students with knowledge and understanding to interpret laboratory indices and results to specific or combined pathophysiological changes seen in various diseases.

6. Learning Outcomes

Upon completion of this module students will be able to:

Knowledge

- Explain the importance of patient clinical history to the laboratory staff to support verification and validation of laboratory examination findings Explain the pathophysiological changes associated with laboratory diagnosis findings
- Explain the role of iatrogenic factors that influence laboratory findings.
- Review ethical issues in biomedical laboratory practice and relevance to patient care services

Application of Knowledge:

- Explain the pathophysiological processes that lead to changes and variations in laboratory findings.
- Identify potential iatrogenic factors that will influence laboratory results.
- Explain and describe ethical implications of laboratory results to the provision of patient care services.

Attitude:

- Practice and apply ethical principles to clinical and professional conduct.

6. Indicative Content:

- History taking and general examination of the patient
- Laboratory request form information and importance of well completed laboratory request form to the biomedical laboratory scientist
- Laboratory diagnosis findings and integrated interpretation in Pathophysiology of common medical conditions:
 - ❖ Iatrogenic sources of error in specimen handling
 - ❖ Pathophysiology of inflammation
 - ❖ Pathophysiology of the immune response
 - ❖ Pathophysiology of metabolic disorders of carbohydrates, lipids, proteins, vitamins
 - ❖ Endocrine disorders
 - ❖ Pathophysiology of Renal function diseases
 - ❖ Pathophysiology of liver function diseases
 - ❖ Pathophysiology of cardiac function diseases
 - ❖ Pathophysiology of pulmonary diseases
 - ❖ Pathophysiology of malignant diseases

7. Teaching Methods:

- Lectures
- Case studies
- Group discussions
- Assignments
- Self directed learning

8. Assessment methods:

Continuous Assessment: 40%

Punctuality and attendance

Continuous Assessment test

Assignments

Final exam: 60%

9. Assessment Pattern:

Component	Weight (%)
In-course assessment	20
CATs	40
Final assessment	40

12.Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students

14. Teaching /Technical assistance

- Tutorial assistant
- LDC Projector
- White board and markers
- Flip charts and markers
- Microbiology diagnostic instruments
- Reagents and materials

14. Indicative resources and Recommended Reading:

- Leesson T. and Leesson R. (2001). *Basic Pathology*. (3rd edition)
- Macleod's Clinical Examination by Graham Douglas, Fiona Nicol and Colin Robertson

- Burkitt, H. G., Stevens, A., Lowe, J. S., Young, B. (2009). *Wheaters basic histopathology: a colour atlas and text*. (5th ed.). New York, USA: Churchill Livingstone.

12.35 Hematology IV and Immunoheamatology III

Module Code:	Module N0	Course name	Subject Units:	Credits:
HIM 5513	35	Hematology IV & Immunoheamatology III	1. Hematology IV	5
			2. Immunoheamatology III	10

1. **Pre-requisite or requisite modules:** Hematology III & Immunoheamatology II

2.

3. **Administering Faculty:** FST

4. **Allocation of study and teaching hours**

Module study outline	Student hours	Staff hours
Lectures	54	54
Seminars/workshops		
Practical classes/laboratory	40	40
Structured exercises	5	5
Set reading		
Self-directed study	31	31
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	150	150

5. Aims of the module

- This module aims at giving the students a foundation of understanding the principles and operation of automated blood cell counts.
- The module will also equip the students with knowledge and skills in quality assurance and quality control as applied to haematology and immunoheamatology medicine with the aim at improving and diagnostic services and ensuring the safety of both blood donors and recipients.
- The detailed specifics of quality assurance will be described and explained with regard to blood transfusion processes, application of standard operating procedure (SOP), reports & records management
- The module will also describe the a hemovigilance with regard to the maintenance of quality performance and biosafety of equipments based on the principles of monitoring and evaluation in blood transfusion medicine.

6. Learning Outcomes

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

Knowledge:

- Define terms relevant to automation in blood cell counting
- Describe the principles of operation and maintenance of automated haematology analysers
- Describe quality assurance measures used in the haematology laboratory including specimen criteria, analytic error detection and resolution and reporting mechanisms.
- Define hemovigilance and other relevant terms.
- Describe principles of quality assurance in blood transfusion medicine
- Apply biosafety procedures in haematology and immunoheamatology settings

Apply Knowledge:

- Apply the principles of quality assurance and quality control techniques for the haematology settings
- Apply principles for quality assurance and quality control in immunoheamatology settings.
- Manage the quality of blood transfusion services processes.
- Apply biosafety procedures in haematology and immunoheamatology settings

- Maintenance of heamatology and immunoheamatology iautomated instruments

Attitude:

- Demonstrate good professional conduct
- Follow biosafety rules and procedures to ensure provision of safe blood
- Follow directions of the instructor
-

7. Indicative Content:

Haematology unit

Principles of automation in Blood cell counting

- Definitions
- Principle of operation of automation in heamatology
- Cell counting, cell sizing, and cell differentiation
- ❖ Direct current (DC) detection
- ❖ Electrical impedance
- General characteristics of histograms
- Operations
- ❖ Instrument preventative maintenance
- ❖ Instrument calibration
- ❖ Instrument quality control

Quality assurance systems in haematology

- Principles
- SOPs
- Specimen management criteria
- Analytical process control
- ❖ Quality control procedures
- ❖ Flagging and error codes
- Course of actions for problem resolution
- Maintenance tools
- Records management
- ❖ Patient reports
- ❖ Storage, retrieval (archive)
- Follow ups and evaluations quality adherence

Immunoheamatology Sciences unit

Quality assurance systems in Blood Transfusion

- Principles
- SOPs
- Records
- Maintenance tools
- Follow ups and evaluations quality maintenance
- Hemovigilance

immunoheamatology Service Management

- Premises
- Blood donor recruitment and screening
- Procurement procedures
- Budget and audits
- Principles of cell therapy; Principles of Immuno-genetics

Practical:

Demonstrate application of SOPs

Perform instrument preventive maintenance

Perform instrument calibration & quality control procedure and interpret results

Operate automated haematology and immunoheamatology instrument

Interpret instrument error flags and codes

Perform donor recruitment and screening of suitable candidates

Create donor database and maintain records

4. Learning and teaching Strategies:

- Learning and teaching strategy will include lectures, demonstrations and practical exercises, self-directed learning, discussions and student presentations, group discussions, Power point presentations

5. Assessment Strategies:

- Partial examination to assess the student's progress in understanding the principles and knowledge involved in blood bank management, ethics, and legislation.
- Synthesis examination to evaluate overall understanding of the module content.
- Practicals to assess the students capacity to carry out the laboratory tests.

6. Assessment Pattern:

Component	Weight (%)
In-course assessment	20
CATs	20
Final assessment	40

7. Strategy for feedback and students support during module

- Oral feedback will be given in class during the teaching-learning process.
- Questions are answered as they are raised.
- Comments on assignment copies will be given to students

8. Teaching /Technical assistance

6. Tutorial assistant
7. LDC Projector
8. White board and markers
9. Flip charts and markers
10. Microbiology diagnostic instruments
11. Reagents and material

12. Indicative resources and Recommended Reading:

- American Association of Blood Banks : Technical Manual, 14th edition, AABB Press, Bethesda, 2003
- PL Mollison, CP Engelfriet, Marcela Contrelas : Blood Transfusion in Clinical Medecine, 9th edition, 1993
- American Association of Blood Banks: Transfusion Therapy, Clinical Principles and Practice, AABB Press, 2nd edition, Bethesda, 2005
- American Association of Blood Banks: Transfusion Reactions 2nd edition, AABB Press, Bethesda, 2001.
- C Sultan, M Gouault, Heilmann, M Imbert : Aide Mémoire d'Hématologie, Flammarion, 1987
- Lewis S.M. and Bates I. (2001). *Practical Haematology* (9th edition).
- Further reading

- B Genetet, G Andreu, JM Bidet : Aide mémoire de Transfusion Sanguine, Flammarion,
- American Association of Blood Banks : Practical Guide to Blood Transfusion, AABB Press, Bethesda, 2001
- European Commission : Safe Blood in Developing Countries, Principles and organisation, 1995
- C Sultan, M Gouault, Heilmann, M Imbert : Aide Mémoire d'Hématologie, Flammarion, 1987.

12.36 Clinical Chemistry IV

Module Code:	Module No	Course name	Subject Units:	Credits:
CCH 5512	36	Clinical Chemistry IV	Clinical Chemistry IV	10

- 1. Pre-requisite or requisite modules:** Clinical Chemistry III
- 2. Administering Faculty:** FST
- 3. Allocation of study and teaching hours**

Total student hours	Student hours	Lecturer hours
Lectures/Face to Face	36	36
Seminars/workshops	5	5
Practical classes/laboratory	-	-
Structured exercises	10	10
Set reading	-	-
Self-directed study	29	29
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	100	100

4. Aims of the module

- The module aims at providing the student with deep understanding of pathophysiology disorders and analytical techniques of lipids and tumor markers.

- The students will understand the principles and concepts of toxicology and apply the knowledge in biomedical laboratory analysis and diagnosis of toxicology related diseases.
- The toxicology topics explain the consequences of ingestion of toxic elements: (arsenic, mercury, lead etc) and therefore study poisons toxicology.

5. Learning Outcomes

At the end of the module, the student will be able to:

Knowledge:

- Explain the pathophysiological importance of Lipids and Lipoproteins
- Discuss inherited metabolic disorders
- Define toxicology terms
- Define terms relevant to malignancy
- Describe the role of tumor markers in diagnosis, prognosis and progression of malignancy
- interpret specific tumor markers in relation to the type of malignancy

Application of knowledge:

- Correlate lipid and lipoprotein results with disorders
- Correlate diagnostic results with inherited metabolic disorders
- correlate heavy metal and drug levels in blood and urine with toxicity
- Correlate serial tumor marker levels with progression of malignancy

Attitude:

- Demonstrate good professional conduct
- Exercise biosafety standards

6. Indicant Content:

- Pathophysiologic importance of lipoproteins and lipids
- Effect and origin of inherited metabolic disorders.

- ❖ Cholesterol
- ❖ Triglyceride
- ❖ HDL
- ❖ LDL
- ❖ VLDL

Identification of inherited metabolic disorders:

- Glucose 6 phospho-dehydrogenase (G - 6PD)
- Galactosaemia
- Phenylketonia
- Cystic fibrosis
- Haemoproteins

Explain the Clinical Significance of tumour markers

- Alpha-fetoproteins
- CEA
- Human chorionic gonadotropin (HCG) hormone
- Calcitonin
- Cathecolamines
- PSA
- CA-125

General principles of toxicology

Intoxication forms

- Acute intoxication
- Sub-acute intoxication
- Chronic intoxication

Toxic action

- Local action

- General action

Patho-chemical aspect of drug toxicology

Therapeutic drug monitoring and chemical toxicology of:

- Phenytoin
- Lithium
- Digoxin
- Theophylline bronchodilator
- Cyclosporin
- Amino glycoside antibiotics

Drug poisoning with specific agents like

- Paracetamol
- Salicylates
- Alcohol
- Carbon monoxide

Practicals: Perform analytical determinations on blood or urine of:

Inherited disorders:

- Glucose 6 phospho-dehydrogenase (G - 6PD)
- Galactosaemia
- Phenylketonia
- Cystic fibrosis
- Haemoproteins

Tumour Markers

- Alpha-fetoproteins
- CEA
- Human chorionic gonadotropin (HCG) hormone
- Calcitonin

- Cathecolamines
- PSA
- CA-125

Toxicology

- Paracetamol
- Salicylates
- Alcohol
- Carbon monoxide
- Phenytoin
- Lithium
- Digoxin
- Theophylline bronchodilator
- Cyclosporin
- Amino glycoside antibiotics
- Food poisons

10. Teaching strategy

Lectures

Tutorials

Self-directed learning

Laboratory Practical sessions

Presentations

Group discussions

10. Assessment strategy

One CAT 40%, Two Assignments 20 %

One final end of semester Exam 40%

11. Assessment Pattern:

Component	Weight (%)
In-course assessment	20
CATs	40
Final assessment	40

13. Strategy for feedback and students support during module

- Feed-back to students provided mostly after marking of assignments and tests by face to face interactions, through emails and any time during office hours that students approach the lecturer with any queries regarding learning.
- Comments are also made in the students answer booklets.

14. Teaching /Technical assistance

- Tutorial assistants provide teaching backup
- Practical sessions and demonstrations.
- Power point projection.

15. Indicative resources and Recommended Reading:

1. Anderson C. S. and Cockayne S. Clinical chemistry concepts and applications; McGraw-Hill (2003).
2. Appleton & Lange's Outline Review Clinical Chemistry by Linda Gregory, C. Linda
3. Lecture notes on Clinical Biochemistry, A.F. Smith, G.J. Beckett, S.W. Walker, P.W.H. Rae
4. . Wilson; Foster; Kironenberg; Larsen (Eds.) (1998). *Williams Textbook of Endocrinology* (Ninth Edition). Philadelphia, PA. Saunders

5. Koeppen, B; Stanton, B (Eds.) (2008). *Berne and Levy Physiology* (Sixth Edition). Philadelphia, PA. Mosby Publishing.
6. Kumar; Abbas; Fausto; Aster (Eds). (2010). *Robbins and Cotran Pathologic Basis of Disease* (Eighth Edition). Philadelphia, PA. Saunders Publishing.
7. Wartofsky, L; Ende, J (Eds) (2003) *Medical Knowledge Self-Assessment Program : Endocrinology and Metabolism* (Thirteenth Edition)
8. L. Kaplan, AJ. Pesce. *Clinical Chemistry: Theory, Analysis, Correlation* 3rd edition.
9. NW. Tietz, WB. Saunders. *Fundamentals of Clinical Chemistry* 2nd edition

12.37 Medical Parasitology IV

Module Code:	Module No	Course name	Subject Units:	Credits:
MPA 5513	37	Medical Parasitology IV	Medical Parasitology IV	15

1. **Pre-requisite or requisite modules:** Medical Parasitology III
2. **Administering Faculty:** FST
3. **Allocation of study and teaching hours**

4.

Module outline	Student hours	Staff hours
Lectures	54	54
Seminars/workshops		
Practical classes/laboratory	40	40
Structured exercises	5	5
Set reading		
Self-directed study	31	31
Assignments-preparation and writing	10	10
Examination-revision and attendance	10	10
Total	150	150

5. Aims of the module:

The aim of this module is to equip the students with details knowledge and advanced parasitology skills applied in diagnostic and research settings laboratorin diag, morphology and.

In addition the module will equip the students with special staining techniques , mounting and preservation of sepecimens for teaching and research purposes. y.

5. Learning Outcomes

At the end of this module student should be able to:

Knowledge

- Compare and appraise the different parasitology diagnostic techniques.
- Mounting and preservation of parasitology specimens

Application of Knowledge

- Apply appropriate and detailed technique for examination and identification of parasites.

- Application of the different stains used in parasitology laboratory, where and how they should be used.
- Apply quality assurance and quality control on staining and diagnostic procedures
- Apply biosafety principles

Practical Skills

- Analyse and identify particular parasites from given biological specimens.
- Acquire skills of using special stains and modern equipment for examination of parasites.

Attitude:

- Demonstrate good professional conduct
- Follow safety rules and procedures
- Follow directions of the instructor

7. Indicative Content

Collection of specimens

- Techniques of collection, processing and identification of samples for Parasitology examinations; tissue, blood, fluids and stool specimens
- Stains and methods used in parasitology examinations
- Parasite concentration methods
- Cryptococcus staining
- Cryptosporidium staining
- Leishmania
- Microfilaria
- Mounting and preservation of parasitology specimens
- Preservation of specimens

Advanced Diagnostic Parasitology

- Culture methods

- Serology
- PCR

Practicals:

Perform diagnostic procedures microscopic examination and identification:

- Parasite concentration methods
- Cryptococcus
- Cryptosporidium
- Leishmania
- Microfilaria
- Mounting and preservation of parasitology specimens

7. Teaching strategy:

Lectures

Tutorials

Self-directed learning

Laboratory Practical sessions

Presentations

Group discussions

8. Assessment Strategies:

1. Written examination (test) to assess the student's knowledge and understanding of laboratory techniques for identification of parasites.
2. Practical examination to assess the student's practical skills in the diagnosis of different morphological stages of parasites under the microscope.
3. Written assignment, the purpose of which is to help students' present topics on selected modern parasitology diagnostic techniques.
4. Final examination

10 Assessment Pattern (Methods & Weightings):

Component	Weight (%)
In-course assessment	20
CATs	40
Final assessment	40

10. Strategy for feedback and students support during module

Feed-back to students provided mostly after marking of assignments and tests by face to face interactions, through emails and any time during office hours that students approach the lecturer with any queries regarding learning. Comments are also made in the students answer booklets.

12. Teaching /Technical assistance

- Tutorials to provide teaching backup
- Practical sessions and demonstrations. Power point projection.

13. Indicative resources and Recommended Readings

Essential Reading

1. Garcia,L S and Bruckner, D A (1997).Diagnostic Medical Parasitology 3rd edition.ASM Press.
2. Verweij JJ, Laeijendecker D, Brienen EA, van Lieshout L, Polderman AM (2003). "Detection and identification of Entamoeba species in stool samples by a reverse line hybridization assay". J. Clin. Microbiol. 41 (11): 5041-5. PMID 14605136

Further Reading

1. KN. Mendis and R. Carter. Clinical Disease and Pathogenesis in Malaria *Parasitol Today* 11: 2-15. 1995.
2. Bruce-Chwatt LJ: Essential Malariology, 3rd ed. Edward Arnold, Boston, 1999.

3. Beadle, GW. Long, and WR. Weiss, *et al.* SL Diagnosis of malaria by detection of Plasmodium falciparum HRP-2 antigen with a rapid dipstick antigen-capture assay J. Alvar. Leishmaniasis and AIDS co-infection: The Spanish example *Parasitol Today* 10: 160. 1994.

Module 38: Research Project

Level 5/Year 4 (2nd semester)

12.38 Research Project

Module Code:	Module N0	Course name	Subject Units:	Credits:
RPR 5524	Module 38	Research Project	Research Project	30

1. **Pre-requisite or requisite modules:** Biostatistics and Research Methodology
2. **Administering Faculty:** FST
3. **Allocation of study and teaching hours**

Module outline	Student hours	Staff hours
Lectures	-	-
Seminars/workshops	20	20
Practical classes/laboratory	-	-
Structured exercises		
Set reading	-	-
Self-directed study	120	120
Assignments-preparation and writing	-	-
Writing the project and corrections	60	60
Total	200	200

4. Aims of the module

- The module will train the students to apply of theoretical knowledge of research methods into practice of executing a research project.
- The student will be required to demonstrate personal initiative and independent thinking that lead to problem solving strategies.
- In accordance with the UNESCO Working Group established to develop guidelines for quality provision in cross border education, the benchmarking criterion is that an Honors' research project must be an independent biomedical research based project centered on data generation.

5. Learning Outcome

At the end of the module the student will have:

Knowledge:

Implementing a research project and report writing.

Skills: Implementing a research project, writing a report and dissemination the findings.

Attitude:

- Appreciate the value of research.
- Have an inquiring mind and consciousness of time and quality in the whole process.
- Appreciate the role of supervisor.

7. Teaching Strategies:

Supervisor guidance, Group discussions, field visit, practical, consultations

8. Assessment Strategies:

Practical and presentation of the completed research report.

9. Assessment Weighting:

Component	Weight (%)
Written document	30
General Introduction	20
Materials and Methods, Results and Discussion	30
Oral Presentation	20

10. Strategy for feedback and students support during module

- Feed-back to students will be provided by face to face interactions on
- Emails and any time during office hours that students approach the lecturer with any queries regarding proposal, methods to be used and how to interpret the results.
- The student will submit drafts which will be corrected and given back with corrections to be made.

10. Teaching /Technical assistance

The Lecturer or supervisor will guide the students on how the proposal should be structures

The lecturer or supervisor will also give support to the student during literature review and facilitate the student in data analysis and presentation and.

12. Indicative resources

Recommended Reading:

1. General regulations for the end of cycle Dissertation (Final paper) for the Degree – Kigali Health Institute, 2006.
2. Alison, B. and Race P. (2004).The study guide to preparing dissertations and thesis. Routledger Falmer

CUR Final project policy, 201312.39 Clinical Attachment III

Module Code:	Module N0	Course name	Subject Units:	Credits:
CLA 5525	39	Clinical Attachment III	1.Clinical Attachment III	30

1. **Pre-requisite or requisite modules:** Clinical Attachment II
2. **Administering Faculty:** FST
3. **Allocation of study and teaching hours**

Total student hours	Student hours	Staff hours
Lectures	-	-
Seminars/workshops		
Practical classes/laboratory	250	250
Structured exercises	-	-
Set reading		
Self-directed study	30	30
Report writing	20	20
Assignments-preparation and writing	-	-
Examination-revision and attendance		
Total	300	300

5. Aims of the module

- The aim of this module is to equip the student to acquire specialised skills in biomedical laboratory diagnosis and to facilitate independent work as an entry-level of a biomedical laboratory scientist.
- The module will equip the student with the skills to manage and use data in problem solving
- This module will also empower the student to improve on communication skills in biomedical issues.

6. Learning outcomes

Upon completion of this module the student will be able to:

- Application of knowledge:Apply problem-solving knowledge by using patient results and data,

Apply standard operations procedures and quality assurance in the biomedical laboratory services

- Prepare a portfolio of biomedical activities
- Prepare and manage records and data

- Observe professional ethics and confidentiality
- Prepare a written account of research activities.
- Present research activities in a seminar

Practical Skills:

- Work independently as an entry-level of a biomedical laboratory scientist in all areas of the clinical attachment
- Perform research activities to conclude a research question or hypothesis

Attitude:

- Demonstrate professional ethics and confidentiality of patient data

7. Indicative Content:

- The student will practice at the clinical attachment site to develop skills in independent work as an entry level of a biomedical laboratory scientist.
- The student will also be placed in a laboratory of preference in agreement with the supervisor from where he/she will complete research project
- The student will make a portfolio regarding placement in biomedical activities.
- The report will be presented in a seminar or workshop.
- Both the documents and practical presentation of the work will be assessed.

8. Teaching Strategies:

- Self-directed research 30 hr
- Self-directed learning 20 hr
- Hands-on Practice in clinical attachment 250 Hrs

9. Assessment Strategies:

Continuous Assessment of :

- Clinical laboratory Attachment checklist for completion

Final Examination:

- Written examination

- Practical examination
- Research report and presentation

10. Assessment Weighting:

- Continuous Assessment 25%
- Final Examination 75%

11. Strategy for feedback and students support during module

12. Teaching /Technical assistance

13. Indicative resources

Recommended Readings:

1. Amari M., Ngatia P. and Mwakirasa A. O. *A guide for training teachers of Health Workers*, DSE and AMREF (1993); pp 54-74.
2. IBMS (2004) *Criteria and Requirements for The Accreditation and Re-accreditation of BSc (Hons) degrees in Biomedical Science*, UK
3. International federation of Biomedical Lab Scientists (IFBLS) code of ethics (1992) *General assembly of delegates report*
4. International federation of Biomedical Lab Scientists (IFBLS) (1998) *Educational requirements for Medical Laboratory Sciences (1998) Report* adopted by the general Assembly of delegates (GAD), Singapore.

16. UNIT APPROVAL

Dr Protais MUHAYIMANA
Dean of FST

Mr. GAHAMANYI Noel
Vice Dean of FST

Mr. NSENGIYUMVA JMV
Academic secretary of FST

Mr. NSHIMIYIMANA Alphonse
Director of Quality Assurance

Approved by the Academic Senate on.....

APPENDICES

APPENDIX1: LEVEL DESCRIPTORS (FROM THE NATIONAL QUALIFICATIONS FRAMEWORK)

HE Level 1 (Certificate of Higher Education)

Knowledge and understanding	Practice: applied knowledge and understanding	Generic cognitive skills	Communication, ICT and numeracy skills	Autonomy, responsibility and working with others
<p>Demonstrate:</p> <ul style="list-style-type: none"> *a broad knowledge of the subject/discipline knowledge embedded in the main theories, concepts and principles *an awareness of the evolving/changing nature of knowledge *an understanding of the difference between explanations based on evidence and other types of explanations and the importance of this 	<p>Use some of the basic and routine skills, techniques, practices and /or materials associated with the subject/discipline</p> <p>Practice these in routine and non-routine situations</p>	<p>Present and evaluate arguments, information and ideas which are routine to the subject/discipline</p> <p>Use a range of approaches to addressing defined and /or routine problems and issues within familiar contexts</p>	<p>Use a range of routine skills associated with the discipline. for example:</p> <ul style="list-style-type: none"> *convey complex ideas in a well structured and coherent form *use a range of forms of communication effectively in both familiar and new contexts *use standard ICT applications to process and obtain a variety of information and data *use a range of numerical and graphical skills 	<p>Be able to work with little or no supervision</p> <p>Be able to work with others to achieve defined objectives</p> <p>Take responsibility for own work</p> <p>Be able to take a leadership role in group work</p>

HE Level 2 (Diploma in Higher Education)

<p>Demonstrate:</p> <ul style="list-style-type: none"> *a broad knowledge base with substantial depth in their area(s) of study *understanding of a limited range of core theories, principles and concepts *limited knowledge of some major current issues and specialisms *an outline knowledge and understanding of research in the subject 	<p>Use a range of appropriate methods and procedures</p> <p>Carry out routine lines of enquiry, development or investigation into problems and issues</p> <p>Adapt routine practices within accepted standards</p>	<p>Have command of analytical interpretation of a wide range of data</p> <p>Use a range of approaches to formulate evidence based solutions/responses to defined and /or routine problems/issue.</p> <p>Evaluate evidenced-based solutions/responses to defined and /or routine problems/ issues</p>	<p>Use a range of routine skills and some advanced and specialised skills associated with the subject e.g.</p> <p>Convey complex information to a variety of audiences and for a variety of purposes</p> <p>Use a range of applications to process and obtain data</p> <p>Use and evaluate numerical and graphical data</p>	<p>Exercise autonomy and initiative in some activities at a professional Level</p> <p>Take significant managerial/ leadership responsibility for the work of others in a defined area of work</p> <p>Take the lead in planning in a familiar context</p> <p>Take responsibility for carrying out and evaluating tasks</p>
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Level HE Level 3 (Advanced Diploma in Higher Education)

Knowledge and understanding	Practice: applied knowledge and understanding	Generic cognitive skills	Communication, ICT and numeracy skills	Autonomy, responsibility and working with others
Demonstrate: *specialised knowledge with depth in their area(s) of study *understanding of a range of the main theories, concepts and principles of the subject *an understanding of a range of current issues and specialisms *a knowledge of the main research methodologies used in the subject	A command of analysis, diagnosis, planning and evaluation across a broad range of technical functions Formulate appropriate responses to resolve problems	Identify and analyse routine professional problems and issues Draw on a limited range of sources in making judgements	Communicate in a variety of forms and to a variety of audiences using structured and coherent arguments Communicate the results of their work accurately and reliably, identifying the broader principles, issues and impact Be able to use a range of IT skills	Take responsibility for their own learning Exercise some degree of autonomy in a few activities at professional Level Demonstrate an ability to take decisions at a professional Level in familiar contexts

Level 4 (Ordinary Degree)

Demonstrate: *a broad and integrated understanding of the well established principles of their area(s) of study *the ability to evaluate a selection of the principles, principles, concepts and terminology of their area(s) of study, including some advanced aspects *knowledge that is detailed in some areas and/or informed by developments at the forefront *knowledge of routine methods of enquiry	Use of a selection of the principle skills, techniques, practices and/or materials associated with the subject(s) Use of a few skills etc that are specialised or advanced Practice appropriate routine methods of enquiry to solve problems in their area of study Practice in a range of professional Level contexts which include a degree of unpredictability	Identify and analyse routine professional problems and issues An understanding of the limits of knowledge and an ability to evaluate knowledge Draw on a range of sources in making judgements	Effectively communicate information, arguments and analysis in a variety of forms to specialist and non specialist audiences Deploy the key techniques of the discipline/subject with confidence Use a range of IT skills to support and enhance work Use and evaluate numerical and graphical data	Exercise autonomy and initiative in some activities at a professional Level Practice in ways which take account of own and other's roles and responsibilities Work under guidance with qualified practitioners Take responsibility for own work and manage the work of others
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Level 5 (Bachelor Degree with Honours)

Knowledge and understanding	Practice: applied knowledge and understanding	Generic cognitive skills	Communication, ICT and numeracy skills	Autonomy, responsibility and working with others
<p>Demonstrate: *a systematic understanding of key aspects of their field of study *a critical understanding of the principal theories and concepts *a coherent and detailed knowledge of some areas that are at the forefront of knowledge in the subject(s) *knowledge and understanding of a range of established techniques of enquiry or research methods</p>	<p>Use a range of methods and techniques including some that are specialised, advanced and/or at the forefront of the subject/discipline</p> <p>Be able to transfer knowledge to unfamiliar contexts</p> <p>Carry out a defined research project</p>	<p>An appreciation of the uncertainty, ambiguity and limits of knowledge</p> <p>The ability to identify and solve professional Level problems In familiar and unfamiliar contexts</p> <p>The ability to make judgements where data/information is limited and/or comes from a range of sources</p> <p>Evaluate and consolidate knowledge, skills and thinking in a subject/discipline</p>	<p>Communicate information, ideas, problems and solutions in a variety of formats to both specialist and non-specialist audiences</p> <p>Use a range of software solutions to support and enhance work</p> <p>Interpret, use and evaluate a range of numerical and graphical data</p>	<p>Take personal responsibility for decision making</p> <p>Act autonomously in professional/equivalent activities</p> <p>Work with others to bring about change, development and/or new thinking</p> <p>Reflect on own learning needs and take responsibility for gaining the necessary knowledge and/or skills</p>

Level HE Level 6 (Postgraduate Certificate, Postgraduate Diploma, Masters Degree)

Knowledge and understanding	Practice: applied knowledge and understanding	Generic cognitive skills	Communication, ICT and numeracy skills	Autonomy, responsibility and working with others
<p>Demonstrate: *a systematic and comprehensive understanding of the main areas of the subject/discipline *a critical awareness of current problems and/or new insights at the forefront of the academic discipline *a comprehensive understanding of relevant techniques applicable to their research or advanced scholarship *an understanding of how established techniques of research and enquiry are used in the discipline</p>	<p>Use a significant range of the principle skills, techniques, practices and/or materials, including some at the forefront of developments, associated with their discipline</p> <p>Apply a range of standard and specialised research or equivalent techniques of enquiry</p> <p>Plan and carry out a significant project of research, investigation or development</p> <p>Demonstrate originality in the application of knowledge</p>	<p>Deal with complex issues and make informed judgements in the absence of complete data</p> <p>Analyse, evaluate and synthesise issues which are at the forefront of knowledge</p> <p>Demonstrate original responses to problems and issues</p>	<p>Use a range of advanced and specialised skills as appropriate to the discipline: e.g.:</p> <p>*communicate using a range of appropriate methods to a range of audiences with different Levels of subject expertise *communicate with peers, more senior colleagues and specialists *use a wide range of appropriate software solutions *evaluate a wide range of numerical and graphical information.</p>	<p>Exercise initiative and personal responsibility</p> <p>Demonstrate self-direction and originality in tackling and solving problems</p> <p>Act autonomously in planning and implementing decisions at a professional Level</p> <p>Demonstrate the skills of life-long learning</p> <p>Demonstrate the skills of leadership and the management of resources</p>

APPENDIX 2: Clinical Laboratory Attachment Student Handbook



CATHOLIC UNIVERSITY OF RWANDA
FACULTY OF SCIENCE AND TECHNOLOGY
Department of Biomedical Laboratory Sciences

**Clinical Laboratory Attachment
 Student Handbook**

<p>NAME OF STUDENT</p> <p>.....</p> <p>.....</p> <p>Tel N^o:</p> <p>Email:.....</p> <p>.....</p>	<p>REGISTRATION N^o</p> <p>.....</p> <p>.....</p>
<p>Name and signature of the Dean</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>Tel N0:</p>	<p>Name and signature of the clinical attachment coordinator</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>Tel N0:</p>

Introduction:

The Clinical Laboratory attachment is one of the core modules for the award of CUR Bachelor of Biomedical Laboratory Sciences. The clinical laboratory attachment module is designed to expose the student to various practical procedures, process, applications and skills from which they acquire extra field knowledge, specific skills and hands on in performing analytical procedures in the field of medical laboratory services. Students will apply also the skills and knowledge gained in the class room to the day-to-day laboratory environment. This clinical laboratory attachment handbook is therefore prepared with the intention to provide orientation and guidelines to students and their field supervisors on various tasks to be performed in different medical laboratory disciplines on work bench stations.

Clinical Laboratory Attachment will be conducted in health centers, district hospitals, referral hospitals, and other medical and research laboratory settings, which offer practical analytical procedures and processes relevant to students theoretical education. The clinical laboratory attachment sites will be vetted and approved by the CUR. The facilities which meet these criteria will provide to the students the opportunities to:

- Apply theoretical knowledge in managing patient specimens, specimens testing and results reporting
- Practice and acquire clinical laboratory analytical skills
- Apply quality assurance/quality control measures in the medical laboratory analysis services
- Prepare a written account of practical skills.
- Familiarize and adapt to the clinical laboratory working environment and biosafety and biosecurity procedures.
- Operate and maintain various laboratory instruments
- Experience practical applications of the necessary occupational safety , biohazards handling and health precautions in different clinical laboratory settings ;
- Experience handling and applications of different diagnostic instruments and other modern medical laboratory technologies.
- Related analytical results and their interpretations to patients clinical conditions

Objectives

The objectives of the clinical laboratory attachment are to provide the student with the opportunity:

- To apply the theoretical knowledge into practice and experience into the real life health care working environment, procedures and problems solving in clinical laboratories
- To convert the theory and practical learning experiences of the biomedical laboratory sciences into skills.

- To exercise clinical laboratory ethics and customer care in the work environment
- To exercise quality and safety procedures in the work environment

Students' activities at clinical laboratory attachment

Clinical laboratory attachment is designed for the student to acquire skills in performing procedures medical laboratory services. Students will apply the knowledge gained on campus to the day-to-day laboratory procedures and analysis of tests at the clinical laboratory attachment site to develop skills across several domains and will be expected to:

- Participate in technical and practical procedures under the supervisor on site with the major aim of gaining technical competences and skills.
- Demonstrate adherence to quality and biosafety procedures and good laboratory practices,
- Demonstrate professional qualities and ethics; accept professional responsibilities and demonstrate team work spirit.
- Document all procedures undertaken and indicate skills gained
- Make a detailed report on the activities done during the attachment period

Criteria for eligibility to clinical laboratory attachment:

- Eligibility for clinical laboratory attachment is possible only after successful completion of all prerequisite courses of Medical Laboratory Sciences program.

Clinical laboratory attachment duration: (100 credits)

- The period for the clinical attachment training is **25 weeks (100 credits)**, split into 3 periods.
- The first attachment of 30 credits is performed at the end of the 2nd semester of the 2nd year.
- The second attachment of 40 credits takes place at the end of the 1st semester of the 3rd year.
- The third and final attachment of 30 credits takes place at the end of the 2nd semester of the 4th year and begins after the final examinations of the academic year.

Clinical laboratory attachment disciplines in which the students will be expected to go through:

The clinical laboratory attachment program is spread over one year during which each student takes training in

- Specimen reception & phlebotomy,
- Medical microbiology,

- Medical parasitology,
- Clinical chemistry
- Haematology, immunohaematology, blood bank and blood transfusion,
- Serology and Immunology,
- Histology , Histopathology & Cytopathology
- Molecular biology.
- Biosafety and biosecurity
- Laboratory quality and good laboratory practices

Recommended clinical laboratory attachment centers:

- Students are offered the opportunity to make a preliminary selection of preferred clinical attachment sites. In most cases, students are assigned to sites for which they have indicated a preference for convenience but the institution will only consent to centers with capacities to offer the required relevant skills
- The recommended centers include health centers laboratories at primary level, district hospitals laboratories in level two, referral hospitals, teaching hospitals, national blood transfusion center and National reference laboratory at level three.

General instructions to students before they undertake the clinical laboratory attachment.

1. The student must have the practical rotation record book during practical attachment to each Medical laboratory Section.
2. Read the instructions carefully before recording any information.
3. Students should notify the Laboratory Supervisor of unsafe procedures in the laboratory, and of means by which they feel safety could be improved.
4. Workers must notify the laboratory supervisor of all accidents, and near-misses as well.
5. The supervising biomedical laboratory scientist /Lecturer should sign recorded practical practice immediately after completion of the practice.
6. Consult the department of biomedical laboratory sciences of CUR when in doubt.
7. Avail the book to department of biomedical laboratory sciences of CUR after completion of attachment for verification

Site supervisors' assessment guidelines.

1. The supervisors are requested to sign only for practice conducted under their direct personal supervision records
2. Students will present their log books for signature of the procedures performed and skills gained immediately after completing the practice.
3. Both the supervisor's names and signature will appear on the signature space, not initials.
4. The signature confirms that the supervisor has verified and assessed the student's performance.
5. The supervisor will inform the students of the hazardous operations, outline the safe practices, and select protective equipment for the student.
6. The supervisor will monitor the safety performance in laboratory by the students who are under training rotations to ensure that the required safety practices and techniques are being employed

General laboratory safety procedures and rules

Laboratory safety

- All students must read and understand the information in this document with regard to laboratory safety and emergency procedures prior to the first laboratory session.
- Students must adhere to written and verbal safety instructions throughout the internship period. Although safety information will be provided by the hospital safety officer before the beginning of internship, following general safety guidelines will help you to work in safe environment during the internship period.
- Analytical section specific safety precautions will be provided by the specific sections such as microbiology, histopathology etc.

General laboratory safety

- The students are expected to strictly adhere to biosafety rules and procedures while in the laboratory working environment.
1. Must wear personal protective equipment (PPE) (gown, gloves, masks, face shield or glasses etc.) when working with hazardous or toxic materials and change when contaminated. The PPE must be left in the laboratory, in the assigned area after work Schedule.

2. Shoes should be fluid impermeable material and cover the entire foot.
3. The application of cosmetics within the laboratory is strictly prohibited.
4. Contact lenses should not be worn while working in the laboratory.
5. Always cover any cut, insect bite or open wound with water-proof adhesive dressing.
6. Gloves should be removed (unless stated to wear) before handling telephones, computer keyboards, laboratory equipments, doorknobs, etc.
7. Eating, drinking, smoking and chewing gum are prohibited in the laboratory.
8. Storage of food or drink is not allowed in laboratory refrigerators.
9. Mouth pipetting must not be done.
10. Laboratory working surfaces shall be decontaminated with a disinfecting solution after the spill of blood or body fluid.
11. Needles should not be recapped or removed from a disposable syringe.
12. Discard used syringes, needles and other sharps (glass slides, glass pipettes, knives, etc.) in specified containers.
13. If equipment shows any problem while being used, report immediately to your supervisor. Never try to fix the problem yourself.
14. Follow the standard safety precautions when using a centrifuge.
15. Hands should be washed with soap and water after handling hazardous and infectious materials.
16. Biological safety cabinets (Class I or II) should be used to avoid aerosolization or droplets.
17. Equipment contaminated with blood or other body fluids should be decontaminated and cleaned before use.
18. All waste and contaminated materials (clinical specimens, bacterial cultures) should be disposed in appropriate containers.
19. Inform your supervisor about any accidents, spills or potential hazard.

Laboratory Chemicals safety care

1. All chemical and hazardous materials are handled according to material safety data sheet (MSDS)
2. The students must know the color coding and numerical rating of chemicals or materials for health hazard, fire hazard, reactivity hazard and specific hazard (reactivity with water) (NFPA label).
3. The students must use volatile and flammable compounds only in a fume hood.
4. It is unsafe to return unused chemicals to their original container.

5. Chemical waste must be disposed of in proper containers according to manufacturer's instructions as outlined in MSDS

Emergency response

1. Safety and fire alarm posters must be read by all students and follow the instructions during an emergency.
2. They must know the location of fire extinguisher, fire exits, and first aid kit and eyewash solution in your lab and know how to use them.
3. They must know the building evacuation procedure in an emergency.

Management tasks which will be accomplished during clinical laboratory attachment

A. Documentation

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Supervisor Assessor signature
1	Read & understand the guidelines/procedures and forms requirements for entry of specimens in available system.			
2	Read & understand the procedures of reporting of an incident.			
3	Apply section safety policies and procedures.			

B. Specimen management

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	Follow specimen receiving procedures.			
2	Sorting out of specimens according to laboratory policies and procedures.			
3	Sorting specimens according to their turnaround time (TAT).			
4	Record and report specimen problem, if required.			
5	Apply specimen acceptance/rejection criteria.			

C. Laboratory information system (LIS):

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	Orientation of LIS for specimen entry			
2	Learn how to generate daily data of specimens received and recorded at reception.			
3	Follow the test order status.			

D. Processes management skills:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	Acquaint with Lab organization and work flow.			
2	Learn referral procedures for unavailable tests.			
3	Use appropriate labels (code) for specimen tubes and containers.			
4	Learn the procedures for management of internal supplies; the locations of equipments and supplies in the unit.			
5	Learn time management; appropriate timing of specimens' delivery to departments and timely results dispatch.			
6	Learn proper communication with other departments in the hospital for efficient delivery of services.			
7	Learn the procedures of inventory, ordering and receiving supplies to sustain testing services			

Laboratory Training Coordinator:

Name:

Signature:

Date:

Laboratory technical skills that will be accomplished during attachment

Phlebotomy

Goal:

- To acquire practical skills of good phlebotomy practice and venous blood collection techniques during the internship period.

Objectives: to practice and acquire skills to

- ❖ Disinfect the blood collection site with appropriate disinfectant.
- ❖ Apply a tourniquet and for desirable time.
- ❖ Identify the preferred venous access sites.
- ❖ Insert the needle properly for blood withdrawal.
- ❖ Take care of the patient to avoid complications during and after blood collection process.
- ❖ Manage the waste within the phlebotomy room

A. Preparation for blood specimen collection:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	Ensure that the test request is ordered by the treating physician.			
2	Identification of proper anticoagulant /additive tube, volume and specimen considerations to be followed for each of the various color coded tubes (syringe system, vacutainer system).			
3	Ensure proper patient identification, labeling of the tubes and review of request slip for the type of test requested.			
4	Pretest selection of blood withdrawal material.			
5	Registration of the specimens in the laboratory information system/register.			

B. Technique for blood specimen collection:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	Ensure that the patient is well prepared prior to blood collection (adult, pediatric and infant).			
2	Detection of preferred venous site and the factors to consider in site selection.			
3	Proper application of tourniquet and knowledge of hazardous effects of prolonged tourniquet application upon laboratory values.			

4	Disinfection of blood collection site and proper insertion of the needle for blood withdrawal (adult, pediatric and infant).			
5	Special precautions for blood withdrawal and inoculation into appropriate culture media for microbiological investigations.			
6	Post withdrawal procedures for specimen management; transport, preservation and storage			

Laboratory Training Coordinator:

Name:

Signature:

Date:

1. Medical Microbiology

Goal:

- To acquire practical skills of standard of processes of microbiological examinations and identification of bacteria during the internship period.

Objectives:

- ❖ To practice different methods of microbial sterilization
- ❖ To prepare culture media for microorganisms growth and isolation
- ❖ To select appropriate media for various clinical specimens.
- ❖ To process specimens for isolation of pathogenic microorganisms.
- ❖ To identify microorganisms encountered in the clinical laboratory.
- ❖ To exhibit knowledge of environmental influences on microbial growth.
- ❖ To differentiate between normal flora and pathogens.
- ❖ To interpret antimicrobial sensitivity patterns.
- ❖ To apply methods of sterile techniques in the laboratory at all times.

A. Microbiology Specimens reception:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	Examine the labeling of the container and request slip for the type of test requested.			
2	Review specimen type, appropriateness of the container and quantity required.			
3	Collect suitable specimens for each test; acceptance/rejection criteria			
4	Register specimens in laboratory information system or logbook			
5	Appropriately manage specimens within TAT; distribution, and testing			

B. Preparation of culture media:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	Skills and techniques for preparation of bacterial and fungal culture media used in routine microbiology laboratory e.g., SS agar, TCBS agar, Selenite F broth, alkaline peptone water, blood agar, Sabouraud's dextrose agar etc.			

C. Microbiological analytical techniques and procedures:

	TASKS	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
I	Specimen inoculation and incubation:			
1	Specimen inoculation on appropriate laboratory media using standard streaking technique.			
2	Selection of single colony of possible pathogen and streaking purity plates.			
3	Incubation of inoculated plates at appropriate temperature and atmospheric condition (aerobic, anaerobic, CO ₂).			
4	Application of quality control procedures and methods			
II	Gram staining:			
1	Preparation of bacterial smear from pure growth and Gram staining of the smear using standard procedure.			

2	Preparation and quality control of gram stain reagents			
3	Examination of gram stained slide to determine gram reaction (G+ve or G-ve) and cell morphology and arrangement.			
III Special colony characteristic:				
1	Identification of bacterial reaction on culture media: hemolysis on blood agar plate (alpha, beta, and gamma). Lactose fermenters, non-lactose fermenters colonies			
2	Examination of pigment production.			
3	Special odor produced by certain bacteria (fruity, fishy etc.).			
4	Examination of swarming growth.			
IV Important biochemical tests:				
1	Catalase test(<i>to differentiate staphylococcus from streptococcus</i>)			
2	Spot oxidase test(<i>to help identify Neisseria, Pseudomonas and Vibrios</i>)			
3	Coagulase tube test and staph latex kit(<i>to identify Staphylococcus aureus</i>)			
4	Optochin disk(<i>to identify Streptococcus pneumoniae</i>)			
5	X and V factor disks (<i>to help identify Haemophilus species</i>)			
6	Bacitracin disk (<i>to identify Group A Streptococci</i>)			
7	Novobiocin disk (<i>to differentiate S.epidermidis from S.saprophyticus</i>)			

V	Bacterial identification: kits and automated systems			
1	Use of 0.5 McFarland standard			
2	Use of rapid identification kits: Analytical Profile Index (API) system e.g., API 20 E			
3	Use of automated system for bacterial identification e.g., Microscan, Vitek, Phoenix etc.			
VI	Antibiotic susceptibility test: disk diffusion and automated system			
1	Use of 0.5 McFarland standard			
2	Use of Kirby Bauer disk diffusion method and recording and interpretation of susceptibility results.			
3	Use of automated system for antibiotic susceptibility e.g., Microscan, Vitek, Phoenix etc.			
4	E-test for detection of minimum inhibitory concentration (MIC).			
5	Detection of Methicillin Resistant <i>Staphylococcus aureus</i> (MRSA).			
6	Detection of Extended spectrum β -lactamase (ESBL) producing organisms.			

D. Special tasks for different benches:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
I	Urine bench:			
1	Application of semi-quantitative colony			

	counting techniques for significant bacteriuria.			
2	Calculation of number of organism in a sample for significant bacteriuria.			
II	Blood and other sterile body fluids bench:			
a.	Blood:			
1	Processing of positive blood cultures on appropriate culture media for isolation and identification of pathogenic organism using appropriate procedures/system.			
2	Placing blood culture bottles into available blood culture system (e.g., BACTEC, BACTALERT etc.)			
b	Cerebrospinal fluid (CSF):			
1	Use of latex agglutination technique for CSF specimen to detect possible causative agent.			
2	Immediate reporting of results of above two tests to laboratory supervisor for confirmation and reporting if needed.			
2	Gram staining of centrifuged CSF specimen (from deposit) for the type of organism.			
c	Other body fluids (e.g., peritoneal (ascetic) fluid):			
1	Apply standard staining procedure (Gram stain and or AFB stain).			
2	Processing of specimens on appropriate culture media for isolation and identification of pathogenic organism.			

III	General microbiology bench (swabs):			
1	Inspection of request form for the type of specimen (pus, wound, throat, ear, eye, nasal, high vaginal swab etc.) and type of test requested.			
2	Identification of suspected pathogen using available identification system			
3	Direct microscopic examination of Gram stained smears and recording type of bacteria and other pathological cells.			
4	Differentiate between normal flora and possible pathogens.			
IV	Respiratory bench (Sputum and Endotracheal tube secretions (ETT):			
1	Inspection of request form for the type of specimen (sputum or ETT) and type of test requested.			
2	Identification of suspected pathogen using available identification system.			
3	Direct microscopic examination of Gram stained smears and recording type of bacteria and other pathological cells.			
4	Differentiate between upper respiratory tract normal flora and possible lower respiratory tract pathogens.			
5	Inoculation of specimen on appropriate laboratory culture media and incubation at suitable temperature for growth.			
V	Stool bench:			
1	Processing of specimen on appropriate selective media for isolation of <i>Salmonella</i> and			

	<i>Shigella</i> species.			
2	Serotyping to identify <i>Salmonella</i> , <i>Shigella</i> and <i>Vibrio</i> species.			
3	Processing of specimen on appropriate selective media for isolation of <i>Vibrio cholerae</i> .			
VI	Mycobacteriology bench:			
1	Use of required personal protective equipment (PPE).			
3	Inoculation of specimen on appropriate culture media (Lowenstein Jensen [LJ], Middlebrook) and observing growth.			
3	Preparation of specimens by decontamination concentration method.			
4	Preparation of specimen for molecular diagnosis, if available			
5	Preparation of specimen for immunofluorescence.			
6	Anti-mycobacterial sensitivity testing.			
7	Microscopic examination of ZN stained slide for the presence of acid fast bacilli.			
8	Ziehl-Neelsen (ZN) staining for acid fast bacilli (hot/cold method).			
9	Immunofluorescence test and recording of result.			
VII	Mycology bench:			
1	Recognition of colony characteristics for yeast on culture media.			
2	Examination of macroscopic features of molds/filamentous fungi			
3	Gram's staining for yeast.			

4	Inoculation of dermatological specimens on appropriate culture media for isolation of molds/filamentous fungi.			
5	Confirmation of <i>Candida albicans</i> by germ tube test.			
6	Direct microscopic examination of dermatological specimens by KOH method.			
7	Confirmation of other <i>Candida species</i> by available biochemical tests.			

E. Quality control:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	Participate in quality control procedures.			
2	Broad knowledge of infection control measures applied in microbiology lab.			
3	Quality control for culture media prepared in the laboratory (sterility testing).			
4	Quality control of the biological materials.			
5	Quality control of instruments (freezers refrigerator, incubators, autoclave etc.).			
6	Quality control of sterilization procedure for freshly prepared laboratory media and decontamination of hazardous materials.			
7	Quality control for growth of organisms on culture media using standard organism.			
8	Quality control of antibiotic disks by appropriate test.			
9	Broad knowledge of infection control measures applied in microbiology lab.			
10	Quality control of staining reagents.			

Laboratory Training Coordinator:

Name:

Signature:

Date:

2. Medical parasitology

Goal:

- To acquire practical skills of parasitological examinations and identification different parasites during the internship period.

Objectives:

- ❖ To collect appropriate specimens type, quantity and quality for requested tests.
- ❖ To preserve and process specimens for requested tests.
- ❖ To exhibit knowledge of different types of clinically significant parasites.
- ❖ To identify different diagnostic stages of clinically significant parasites.

A. Specimens reception:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	Apply specimens acceptance/rejection criteria			
2	Ensure transportation of specimens in appropriate conditions to Parasitology laboratory.			
3	Review specimen type, appropriateness of the container and quantity required.			
4	Register specimens in laboratory information system or logbook.			
5	Examine the labeling of the container and request slip for the type of test requested.			

B. Parasitological techniques and procedures:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
I	Stool specimen:			
1	Macroscopic examination of stool:			
	(Color, consistency, appearance, adult worms, segments of cestodes, etc.).			
2	Microscopic examination of stool			
	Direct saline and iodine smears.			
3	Modified Kinyoun's or other acid fast staining technique and identification of diagnostic stages			
4	Sedimentation concentration technique and identification of diagnostic stages.			
5	Flotation concentration technique and identification of diagnostic stages			
6	Trichrome or other staining technique and identification of diagnostic stages			
II	Identification of parasites			
1	Pinworm detection specimen collection techniques.			
2	Viability test / hatchability test			
3	Hydatid cyst specimen processing and Examination.			
4	.Sputum specimen processing and examination.			
5	<i>Giardia /Cryptosporidium</i>			
6	H/worm, ascaris, enterobius, trichuris			
7	Protozoan parasites			
8	nematodal parasites, ceastodes			
9	Helminthes.			
III	Urine examination			

	Examination of urine sediment for parasites (<i>S. haematobium</i> , <i>T. vaginalis</i>)			
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C. Quality control:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	Participate in quality control procedures.			
2	Use of standard quality control diagnostic stage slides for different parasitic diseases recommended for specific purposes			
3	Quality control for culture chemicals prepared in the laboratory.			
4	Quality control for instruments (freezers refrigerator, incubators, microscopes, etc.).			
5	Quality control for different staining methods.			
6	Quality control of sterilized materials.			
7	Quality control of the parasitological materials			

Laboratory Training Coordinator:

Name:

Signature:

Date:

5. Clinical chemistry

Goal:

- To acquire analytical skills in clinical chemistry and management of processes during internship period.

Objectives:

- ❖ To learn different techniques in clinical chemistry.
- ❖ To learn special techniques applied in clinical chemistry.
- ❖ To analyze and interpret clinical chemical values for healthy and disease conditions.
- ❖ To apply calibration and quality control procedures for various tests and criteria for calibration acceptance or rejection.
- ❖ Learn the management of critical specimens and results

A. Clinical chemistry specimens collection and reception

	TASKS	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
I	Specimen Management			
1	Collect suitable specimens for various tests; apply specimen acceptance/rejection criteria			
2	Review specimen type (e.g., whole blood, serum, plasma, body fluids etc.), container appropriateness and quantity required.			
3	Register specimens in the laboratory information system or logbook			
4	Management of specimens according to test turnaround time.			
5	Apply proper management of specimens for later			

	reference or testing.			
7	Learn referral procedures for unavailable tests			
II	Basic techniques and Procedures			
1	Preparation of reagents, buffers and standards			
2	Reading and recording of the results			
3	Preparation of standards, controls, buffers, diluents, reagents and wash buffers.			
4	Understand the steps for instrument setup and programming			
5	Reading and recording of the results.			

B. Reagent and Instruments management:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	Application of SOP.			
2	Understand principles of tests.			
3	Instrument set-up for analysis.			
4	Samples/reagents preparation.			
5	Operation of the instrument.			
6	Recognize of critical results/ values and immediately report these findings to the supervisor			
7	Understand instrument breakdown/trouble-shooting and corrective maintenance			
8				

C. Analytical testing of clinical chemistry profiles:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating:0-10	Assessor signature
1	Liver function: ALT, AST, AP, GGT, Total bilirubin, direct and indirect bilirubin, total protein, albumin, globulin and A/G ratio.			
2	Renal function: Creatinine, urea, BUN, uric acid, creatinine clearance test.			
3	Lipid profile: Total cholesterol, triglycerides, HDL-cholesterol, LDL- cholesterol and calculation of risk factor.			
4	Cardiac function tests: Creatine kinase, LDH, troponin, myoglobin.			
5	Bone metabolism: Total calcium, ionized calcium, phosphorous, uric acid, vitamin D parathyroid hormone			
6	Pancreatic function: Alpha-amylase, Lipase			
7	Interpretation of results and recognition of critical values			
8	Electrolytes			
9	Electrophoresis: HB, Proteins			

D. Special clinical chemistry tests:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
I	Tumor markers, hormones, vitamins			

E. Quality control:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	Participate in quality control procedures.			
2	Understand and apply Westgard rules.			
3	Apply knowledge where controls needed for certain parameters.			
4	Run daily controls and evaluate for acceptability.			
5	Evaluate troubleshooting when quality control results show discrepancies			
6	Apply knowledge when calibration is needed			
7	Evaluate the criteria of accepting or rejecting the calibration			

Laboratory Training Coordinator:

Name:

Signature:

Date:

3. Hematology, blood bank and blood transfusion

Goal:

- The students will undergo on-site training in order to acquire practical skills of and management of hematology processes and procedures, application of routine and specialized analytical hematological techniques and acquire skills in blood bank and blood transfusion techniques during the internship period

Objectives:

- ❖ To perform routine hematological tests for haematology parameters: CBC, differentials, ESR, haematocrit, RBC, coagulation profile, derived parameters, etc.
- ❖ To prepare and stain blood films with routine and special stains.
- ❖ To exhibit knowledge of preparation of films for bone marrow specimens.
- ❖ To perform special techniques (e.g., Hb electrophoresis, sickle cell screening, spherocytosis screening etc.)
- ❖ To prepare films from body fluids (CSF, peritoneal fluid etc.) and cell counting.
- ❖ To apply knowledge of flowcytometry operation and sample preparation, for CD4.
- ❖ To apply QC procedures to ensure quality of results
- ❖ To develop technical accuracy and self-confidence by experiencing routine functions of Blood Bank.
- ❖ To recognize and resolve discrepancies for blood grouping.
- ❖ To exhibit knowledge of standard techniques used for ABO and Rh typing, compatibility testing, antibody identification, antigen typing, and preparation of blood components before transfusion.
- ❖ To acquaint with the procedures of donor selection and issuing of blood and blood products for transfusion.

A. Specimen collection and reception:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	Collect suitable specimens for haematology tests and apply specimen acceptance/rejection criteria			
2	Review specimen type, appropriateness of the quantity required			
3	Examine the labeling of the tube and request slip for the type of test requested			
4	Register specimens in laboratory information system or logbook			
5	Review specimen type, appropriateness of the quantity required for blood grouping and compatibility tests			

B. Complete blood count bench

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
I	Automated cell counter:			
1	Instrument operation: Start up, shut down procedures..			
2	Regular maintenance procedures			
3	Run daily controls and evaluate for acceptability.			
4	Evaluation of specimen suitability for testing (not clotted sample).			
5	Run patient specimens for routine testing.			
6	Correlate and evaluate scatter grams for normal			

	and abnormal values.			
7	Read the print out of the results and identify normal and critical values.			
8	Interpret the results and evaluate before dispatch			
II Microscopic examination of blood film:				
1	Preparation of thin blood film stain reagents and staining procedures			
2	Identification of normal and abnormal RBC morphology.			
3	Identification of different subsets of normal leukocytes.			
4	Perform differential WBC count.			
5	Estimation of platelet count from the film.			
6	Spot identification of leukemic blasts.			

C. Coagulation bench

	TASKS	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
Automated coagulometer:				
1	Instrument operation procedure; Start up , shut down of the instrument.			
2	Regular maintenance procedures			
3	Run daily controls and evaluate for acceptability.			
4	Evaluation of specimen suitability for testing (not clotted sample).			
5	Run patient specimens for routine coagulation			

	testing (PT, PTT and INR)			
6	Run fibrinogen/thrombin and D-dimer.			
7	Special coagulation studies as available (e.g. Anti-thrombin III, factor assays, platelet studies).			
8	Identification of normal and critical values.			

D. Blood preparation for transfusion and immunohaematological tests bench

	TASKS	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	Preparation of blood unit components including packed red cells, platelets, washed RBCs, cryoprecipitate and FFP.			
2	Storage of blood and blood components at appropriate temperature according to AABB standards.			
3	Follow quality control measures according to AABB standards.			
4	Learn and understand the therapeutic advantages of blood and blood components.			
5	Follow AABB standards for discarding expired blood and infectious blood units			
6	Ensure applying AABB standards for detection of blood borne infections and unit labeling.			

D. Manual techniques and procedures:

	TASKS	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
I	ESR (erythrocyte sedimentation rate)			
1	To set up an ESR.			
2	Performing the test with normal and small sample size (e.g. from babies).			
3	Read and report results.			
4	Procedure to set up an ESR.			
II	Osmotic fragility test:			
1	Preparation of hypotonic saline solutions from the stock solution.			
2	Proper distribution of heparinized blood in each tube.			
3	Performing the test with normal and small sample size (e.g. from babies).			
4	Reading tubes using spectrophotometer.			
5	Interpretation of results under the supervisor's guidance			
III	Screening test for sickle cell anemia:			
1	Preparation of high morality phosphate buffer.			
2	Performing all the steps of the test.			
3	Reading and interpretation of results.			

IV	Detection of malarial parasites in blood films:			
1	Proper identification of different stages of malarial parasites.			
2	Recording and interpretation of results under the supervisor's guidance.			
V	Body fluids preparation:			
	Preparation of the cell for manual counting by hemocytometer.			
	Preparation of cell sediment without cell destruction.			
	Preparation and staining of smears from the sediment for morphological examination.			
	Reading and interpretation of results under supervisor's guidance.			

F. Bone marrow film preparation bench:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	Preparation of bone marrow smears.			
2	Preparation of smear from bone marrow clot.			
3	Special stain for bone marrow smears.			
4	Processing of specimens for flow cytometry and cytogenetic analysis (if applicable).			

E. Pre-transfusion compatibility testing bench:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	ABO (forward and reverse) grouping, Rh typing (including D/Du) and DAT.			
2	Identify blood groups from adult and cord blood using appropriate methods.			
3	Resolve any discrepancies in forward and reverse ABO grouping using appropriate methods in practice.			
4	Recognize and apply appropriate antibody screening tests including warm and cold anti-human globulin (AHG).			
5	Single antibody identification test if antibody screening is positive.			
6	Multiple antibodies identification using enzyme treated cells.			
7	Providing suitable blood for transfusion: Patient identification, record review, pre-transfusion testing of the patient's blood, and testing of donor unit for ABO and Rh compatibility.			
8	Cross matching using gel method, and manual and automated tube methods.			
9	Routine cross matching procedures at room temperature, 37°C and Indirect anti-globulin test (IAT) methods.			

10	Cross matching in routine and emergency situations			
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F. Special advance techniques:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	Antibody titration and interpretation of its results.			
2	Antibody elution and other special techniques.			
3	Identify special advance techniques need to be performed with normal reference range for each technique.			

Laboratory Training Coordinator:

Name:

Signature:

Date:

4. Serology and Immunology

Goal:

- Students need to acquire practical skills in serology and immunology for the diagnosis of various viral diseases.

Objectives:

- ❖ To acquire knowledge in routine serological and immunological techniques.
- ❖ To use different techniques and equipments available for performing routine
- ❖ To apply knowledge in operating immunology and serology testing instruments
- ❖ Interpretation and evaluation of significance of immunology and serology results

A. Techniques and procedures:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
I	Antigen -antibody reactions: Agglutination, precipitation, flocculation techniques			
2	Follow the standard procedures correctly			
3	Serial dilution of the test sample.			
4	Reagents preparation.			
5	Identification of negative and positive samples.			
6	Calculation of titer for diluted sample			
II	Reagent preparation.			

1	Dilution of the sample whenever needed.			
2	Follow the laid down instructions.			
3	Follow proper incubation time and temperature.			
4	Calculate the concentration from the standard curve for diluted specimens.			
III	Immunoblot technique: Western blot, RIBA			
1	Follow the procedures correctly.			
2	Comparison of the test strip result with the control strips.			
3	Identification of negative and positive results.			
IV	Immuno -Enzymatique Assays technique(ELISA)			
1	Follow the procedures correctly.			
2	Instrument operation procedure			
3	Comparison of the test strip result with the control strips			
4	Identification of negative and positive results.			
5	Interpretation of results			
IV	Immuno-fluorescence technique:			
1	Dilution of the test specimen.			
2	Reagents preparation.			
3	Follow the procedures correctly.			
4	Visualize the slides under fluorescent microscope under supervision.			
5	Calculation of the titer			

V	Other tests:			
1	TPHA (<i>Treponema pallidum</i> haem-agglutination assay).			
2	RPR (rapid plasma reagin).			
3	CRP (C-reactive protein).			
4	Widal.			
5	Brucella.			
6	ASO (Antistreptolysin O titer).			
VI	Blood donor testing:			
1	The 6 major tests included in the panel (HIV, HBV, HCV, HTLV, CMV, RPR)			
2	Follow standard methodology for these tests.			
3	Interpretation of these tests results.			
VII	Nephelometry:			
1	Starting up the instrument.			
2	Regular maintenance procedures.			
3	Running of controls daily and evaluate its acceptability.			
4	Evaluation of specimen's suitability for testing.			
5	Specimen preparation for testing.			
6	Routine testing of patient specimens.			
7	Reading results printout and identify normal and critical values.			
VIII	Chemiluminescence:			
1	Starting up the instrument.			
2	Regular maintenance procedures			
3	Run controls daily and evaluate its acceptability.			

4	Evaluation of specimen's suitability for testing.			
5	Specimen preparation for testing.			
6	Routine testing of patient specimens.			
7	Reading results printout and identify normal and critical values.			
IX	Fluoro-enzyme immunoassay:			
1	Start up the instrument			
2	Specimen/reagent preparation.			
3	Testing of patient specimens.			
4	Reading results' printout and identify positive and negative values.			
5	Regular maintenance procedures.			
6	Panel for different types of allergy			

Laboratory Training Coordinator:

Name:

Signature:

Date:

5. Histology and cytopathology

Goal:

- Students will acquire practical skills of histology, histopathology, cytopathological and histotechnology procedures during the internship. They will acquire skills to prepare and stain different histopathology and cytopathology specimens for pathologist reporting.

Objectives:

- ❖ To recognize appropriateness of specimen type, size, and quality.
- ❖ To preserve and handle specimens for the requested tests.
- ❖ To exhibit knowledge of different stains and staining protocols including immuno-histo/cyto-chemical staining.
- ❖ To carry out the procedure for biopsy and cytology specimens processing, section cutting, and staining
- ❖ Evaluation of the staining quality

A. Specimens reception and processing:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	Evaluate specimens suitability, proper fixation and apply specimens' acceptance/rejection criteria.			
2	Review specimen type, size and appropriateness of the preservative and container for histopathology.			
3	Review specimen type, size and appropriateness of the preservative and			

	container for cytopathology.			
	Examine the labeling of the container and request slip for the type of test requested and confirmation of matching patient- specimen details			
4	Ensure accurate registration of specimens in laboratory information system or logbook			
5	Ensure handling and preservation of specimens in histopathology laboratory			
6	Ensure proper processing of the specimens			
7	Receiving and filing of paraffin blocks, slides' request and reports.			

B. Histotechnology techniques and procedures:

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
I	Specimens handling and preparation:			
1	Specimens handling protocols.			
2	Grossing protocols.			
3	Storage and disposal protocols for biological specimens and other materials.			
4	Decalcification protocols.			

5	Processing protocols.			
6	Embedding protocols.			
7	Preparation of smears for cytopathology.			
9	Preparation of cell blocks for cytopathology			
10	Use of automated systems for special procedures			
II	Microtomy handling and section cutting:			
1	Ensure specimen microtomy and apply the SOP; ensure right thinness of the sections			
2	Ensures understanding and application of standard specimen's processing protocols			
III	Chemical staining:			
1	Routine staining protocols (e.g., Haemotoxylin and Eosin staining).			
2	Special histochemical staining protocols (e.g., tumor markers).			
3	Routine staining for cytopathology (pap smear).			
4	Application of coverslip.			
IV	Immuno-staining:			
1	Antigen retrieval protocols.			
2	Immuno-histochemistry techniques.			
3	Immuno-fluorescence techniques.			
V	Advance techniques: (if available)			
1	<i>In situ</i> hybridization and its processing protocols.			

2	Electron microscopy.			
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Laboratory Training Coordinator:

Name:

Signature:

Date:

6. Molecular biology

Goal:

- Students will acquire practical skills in molecular biology diagnostics and application of results in clinical laboratory medicine and clinical medicine.

Objectives:

- ❖ To identify the right types of specimens received for molecular diagnosis.
- ❖ To understand the importance of contamination hazard in molecular diagnosis.
- ❖ To perform the required tests in an appropriate biosafety and biosecurity environment.
- ❖ To understand the significance of accuracy in molecular testing procedures.
- ❖ To understand the appropriate interpretation of molecular results.

	Tasks	Trainee Performance (Signature)	Supervisor's assessment and rating : Rating of 0-10	Assessor signature
1	Orientation about biosafety and biosecurity measures in molecular biology laboratory			
2	.Application of measures to avoid DNA contamination			
3	Understanding the procedures for molecular biology analysis and precautions in each step: extortion, amplification etc,			
4	Extraction of nucleic acid from different			

	specimens using appropriate methods (manual and automated).			
4	Preparation of DNA for reverse transcription.			
5	Quantification of extracted DNA.			
6	Setting up of thermocycler.			
7	Nucleic acid quantification.			
9	Detection of suspected amplicons using appropriate methods.			
10	Interpretation of obtained results.			
11	Follow contamination monitoring			
12	Management of waste in molecular biology			

Laboratory Training Coordinator Name:

Signature:

Date:

Summary of internship evaluation

Name of the Hospital/Institution providing attachment:

Name of the student:

Student ID:

	Clinical laboratory section	Final Assessment performance Percentage (%)	Comments
1	Specimen reception and anagement		
2	Phlebotomy		
3	Medical Microbiology		
4	Medical Parasitology		
5	Clinical Chemistry		
6	Hematology and Immunohaematology		
7	Serology and immunology		
8	Histology-Histopathology and Cyto-pathology		
9	Molecular biology		
10	Principles of Good laboratory practice, professional ethics and attitude		

Total performance percentage (%) overall		
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Name and Signature of the training Coordinator/supervisor:

Date: -----

Name and signature of the student-----

Date: -----

Appendix 3: List of Core Modules and Teaching Staff

Name of the Lecturer	QUALIFICATION	Module/Component
1. PERMENENT LECTURERS		
1.Dr. MUHAYIMANA Potais	PhD in Biochemistry	General Biochemistry Instrumentation Research Methodology
2.Ms. CHANTAL NYIRAKANANI	Msc. In Medical Microbiology	Medical Parasitology & Entomology General Microbiology Medical Microbiology I Medical Parasitology II Medical Parasitology III Medical MicrobiologyIII Medical Parasitology IV
3.Ms. CLAIRE DUSENGIMANA	Msc. In Medical Microbiology	Immunology I and Virology Medical Microbiology II (Food Microbiology & Medical Mycology) Molecular Biology I Immunology II Molecular Biology II
4.Mr. GODEFROID NZEYIMANA	Msc. In Clinical Chemistry	Phlebotomy and Specimens Management Clinical Chemistry I Clinical Laboratory Management Clinical Chemistry II Clinical Chemistry III Clinical Chemistry IV
5. Mr.SHEMA Clément	Msc. In Medical Laboratory Technology	Hematology I Hematology II & Immunoematology I Hematology III and Immunoematology II

		Hematology IV & Immunohematology III
2. PART TIME LECTURERS		
2. Dr. MBARUSHIMANA Djibril	MSc. In Histopathology	Histology & Cytopathology
		Histotechnology & Histopathology
		Integrated Pathophysiology
3. Dr. NIYODUSENGA Alphonse	Msc In Human Physiology	Human Anatomy & Physiology
4. Mr. NKURANGA JEAN Bosco	MSc. In Analytical Chemistry	Analytical Chemistry
TUTORIAL ASSISTANTS 1. Mr. SENDEGEYA J. Pierre 2. Mr. NDATUMUREMYI Japhet 3. Mr. NZUMVIRIMANA Charles	In charge of practices and clinical attachment	

APPENDIX 3: CONTRIBUTING TEAM

Dr. MUHAYIMANA Protais
Dr. ASHOK Rangaiahagari
Dr. MUGANGA Raymond
Dr. Masaisa Florence
Dr. KARERA Claudine
Dr. MUSONI Emile
Dr. URAYENEZA Yves
Mr. GATABAZI John Baptist
Mr. GAHAMANYI Noël
Ms. NDORICYIMPAYE Ella Larissa
Mrs. UWAMUNGU Schifra

Mr. UMEREWENEZA Daniel
Mr. MUTAYOMBA Sylvestre
Mr. RUGIRA Trojan
Mr. HABARUGIRA Félix
Mr. NDAYAMBAJE Francois Xavier
Mr. NGENDAKABANIGA Jean Marie Vianney
Mr.UMUHOZA Gustave
Mr. UWAYEZU Jean de Dieu
Mr. NSENGIYUMVA JMV
Mr. IYAKAREMYE Jean Pierre
Mrs. MUKASEKURU Alice
Mr. NSENGIYUMVA Cyprien

**APPENDIX 4: MEMORANDUM OF UNDERSTANDING WITH CUR AND
CHUB**