FOREWORD:

The Biomedical Sciences syllabus has been prepared with a broad representation of subject experts supported by the Clinton Foundation. This document is meant for use by lecturers on the Biomedical Sciences Programme to be offered at the Evelyn Hone College in Lusaka, School of Biomedical Sciences at Ndola Central Hospital and the Chikankata School of Biomedical Sciences.

A modular system approach has been used in preparing this document. This approach has an advantage of being easy to modify individual modules whenever need arises especially with the rapid change in technology. Further a semesterised system has been adopted in order for the Curriculum to be readily accepted by the University of Zambia in line with its own Bachelor of Science degree in Biomedical Sciences. The curriculum has been accepted for affiliation and certification by the University since 2000.

AKNOWLEDGEMENTS:
The Ministry of health and the Clinton Foundation wish to thank the members of the Curriculum Steering Committee, all respondents to the initial Training Needs Assessement (TNA) which formed the basis for this review and the subject matter experts that gathered to review this curriculum to its present form.

1.0 INTRODUCTION

Knowledge about health and diseases is the sum contributions of a number of disciplines which can be grouped according to their methods and underlying concepts. Of these, three major categories emerge: the basic sciences including Biochemistry, Physiology and Pathology; the Clinical Sciences and Epidemiology. The Biomedical Sciences constitute the basic Sciences in which the chemical, biological and physical principles are specifically orientated to the understanding of the human body in health and disease.

An understanding of disease or abnormal life processes, together with an appreciation of investigative techniques, requires knowledge of cell biology, genetics, immunology and the effects of environmental damage on living systems. Some diseases may occur as a result of the activities of micro-organisms, an understanding of the nature of such micro-organisms and the means whereby their manifestations are caused, and may be presented, is necessary. The data obtained is quantified and verified by the laws of Mathematics and Statistics. The information generated is used as an essential element in diagnosis and treatment. Graduates from this course will therefore be able to contribute to the work of medical, veterinary and pharmaceutical laboratories where such scientific methods are used.

Given the fast changing pattern of disease in the world further insights of Pathology and mechanisms of disease are emphasised in this curriculum. The need to investigate disease problems is strengthened by inclusion of a unit in Basic research methods under Biostatistics and Epidemiology. This should give confidence to would be Biomedical Technologist to not only originate but also participate confidently in various operational an action research projects.

2.0 THE CURRICULUM-ACCREDITATION AND AFFILIATION

This Curriculum will be examined by the University of Zambia School of Medicine. Under the TEVET Act of 1998, TEVETA is further expected to regulate and accredit the programme. In addition, Medical Council of Zambia will also regulates all public and private health institutions running health programmes for purposes of ensuring that training is meeting all the standards as set out by the Act.

As the Principal stakeholder, the Ministry of health will provide the overall guiding policy on Laboratory training in public institutions, thereby ensuring quality of health care service in the country.

3.0 COURSE STRUCTURE AND PROGRESSION REGULATIONS:

3.1 Course structure

This curriculum is divided into Modules, broken down into Units (to be mastered by students), and elements. The entire curriculum takes a hybridised approach to teaching and learning strategies. This approach combines aspects of innovative and traditional models. In this model, while lecturers still retain their role as facilitators, learners increasingly become involved in their own learning. More and more student centred learning exercises are therefore emphasised in this model

3.2 Programme duration

The duration of the course is 3 years. The first two years are generally college based and at the beginning of the third year of the course, students are placed in approved laboratories to gain the necessary work experience.

3.3 Pre-requisites

Modules will have prerequisites as follows:

- Applied Chemistry and Physics for Analytical Techniques and Instrumentation
- Anatomy and Physiology for Histology
- Applied Mathematics for Biostatistics and Epidemiology
- Cell biology and Human genetics for Molecular Biology
- Biochemistry I for Biochemistry II
- Haematology I for Haematology II
- Immunology for Blood Transfusion Science I
- Medical Parasitology I for Medical Parasitology II
- Hitology for Pathology
- Cellular Pathology I for Cellular pathology II
- Biochemistry II for Clinical Biochemistry
- Medical Microbiology I for Medical Microbiology II (Bacteriology)
- Molecular Biology for All courses in year three
- Cellular Pathology II for Hospital Placement
- Blood Transfusion Science II for hospital placement

3.4 Progression regulations

The grading percentage of marks will be as follows:

A+ ⌈ **86 - 100**
A ⌈ **75 – 85**
B+ ⌈ **70 – 74**
B ⌈ **65 – 69**
C+ ⌈ **55 – 64**
C ⌈ **50 – 54** **Pass mark**
D+ ⌈ **45 – 49**

D ⌈ Below 45

1. In order to progress to the next semester, a student is required to clear all the modules.
2. A student who fails up to two courses with a combination of 2 D+ or 1 D and 1 D+ will be required to sit for a supplementary examination as long as he/she has passed continuous assessment in both the failed modules.
3. A student who fails with 2 D or 3 D+ will be required to repeat the semester.
4. A student who fails supplementary examinations will be required to sit for examinations at subsequent sitting in the failed course.
5. A student who fails three or more courses will be excluded from college.
6. A student will be required to have passed Hospital Placement before he/she can graduate.
7. A student will repeat a module only once.
8. Notwithstanding the above provisions, a student with arrears shall not sit for any subsequent examinations until they have cleared the subjects/modules that are outstanding.

9. A student who fails to complete the course after a **continuous** five years of study shall be eligible for exclusion.

4.0 CAREER PROSPECTS:

Employment opportunities for Biomedical Sciences graduates reflect both the needs for the course and the diversity of career possibilities.

The Ministry of Health and private hospital pathology laboratories have a requirement for suitable graduates to work as Biomedical Technologists / Scientists. As the private sector grows in Zambia some graduates will find jobs in reputable privately owned routine and research medical laboratories.

Pharmaceutical companies, the University of Zambia and medical research organisations, which undertake research and development, employ graduates with special skills and knowledge in Biomedical Sciences.

In addition opportunities exist in manufacturing and cosmetic industry and in veterinary medicine where the effects of a wide range of products may be tested on living organisms. Companies manufacturing laboratory instruments and reagents require Biomedical Scientists for research and development, quality control and product sales.

Outstanding students are encouraged to pursue their studies at degree level. Such higher qualification may be undertaken at a University.

5.0 PROGRAMME AIMS, OBJECTIVES AND COMPETENCES:

5.1 AIM:

To produce knowledgeable and highly skilled Biomedical Technologists capable of providing quality laboratory diagnosis and participating in teaching and research.

5.2 OBJECTIVES:

Upon completion of the diploma curriculum, graduates should be able to:

1. Conduct quality laboratory diagnosis, evaluate and screen drugs, monitor patient treatment, and contribute to the monitoring and control of infections.

2. Manage, supervise and evaluate biomedical laboratory operations, human resources and trainees in a laboratory.
3. Demonstrate Good Clinical Laboratory Practice (GCLP) and professional ethics.
4. Demonstrate appropriate attitudes and cultivate good working relationships with other professional colleagues and clients
5. Participate in Continuous Professional Development (CPD) activities.
6. Pursue higher studies (BSc, MSc, PhD) in Biomedical Sciences

5.3 Major Competences

- Collect and process specimens appropriately.
- Perform diagnostic tests and interpret findings.
- Prepare and refer specimens to a higher-level laboratory.
- Prepare reagents.
- Maintain quality assurance systems.
- Demonstrate Good Clinical Laboratory Practice (GCLP) and adhere to laboratory safety procedures and the code of ethics.
- Operate laboratory equipment and carry out necessary preventive maintenance.
- Manage laboratory information systems and commodity security.
- Communicate effectively with clients and other health professionals.
- Supervise trainees and subordinate staff.
- Perform other duties as necessary.
- Diagnose disease.
- Monitor and evaluate drug efficacy.
- Monitor patient treatment.
- Execute laboratory activities aimed at monitoring and controlling infections in hospitals and the community.
- Participate in Biomedical-related research activities.
- Teach Biomedical Sciences in academic and clinical settings.

6.0 ENTRY REQUIREMENTS:

Prospective students must satisfy the following minimum entry requirements..

6.1 SCHOOL LEAVERS:
5 '0' Levels in English Language, Mathematics, Biology, Physical Science/Combined Science or Chemistry, and any of the following: Physics, Agricultural Science, Geography, Literature in English or Commerce. Candidates must score a minimum of a credit.

6.2 MATURE AGE:
Mature students (aged 23 or over) who do not meet the minimum entry requirements above may be admitted provided there is sufficient evidence of having improved their grades since leaving school in the relevant subjects or show appropriate ability and experience. An accreditation of prior learning and experience will be conducted for candidates holding certificates in Medical Laboratory Sciences.

6.3 HOW TO APPLY:
Applications should be made to: The Manager, Ndola College of Biomedical Sciences or Principal, Evelyn Hone College as desired. Details of application formalities for respective Institutions shall be obtained from the Heads of College/Institution.

7.0 SELECTION OF CANDIDATES:

- Written applications
- Interviews
- Aptitude Tests.

8.0 PROGRAMME EVALUATION:

Major areas of Evaluation - Course aims and objectives, students' entry requirements, course content, teaching/learning activities lecturers' performance and students' assessment.

Evaluation Instruments - questionnaires, structure interviews, observation, check list examinations/tests, records.

Source of Information - Students, Lecturers, Administrators, and Student dropouts.

9.0 SUMMATIVE EVALUATION OF PROGRAMME;

Major areas of evaluation - Course aims, students' entry requirements, course content, learning resources, teaching/learning activities, lecturers, graduates' performance in employment.

Evaluation Instruments - Questionnaires, structure interviews, observation, check list, records, committees, rules and regulations.

Source of Information - Student, lecturers, administrators, student dropouts, graduates' employers, parents, politicians, union officials, and the general public.

10.0 QUALIFICATION FOR ACADEMIC STAFF

The minimum qualification is a Bachelor of Science degree in a Biomedical Science discipline. Additional qualifications: Diploma/Certificate in Education.

11.0 CERTIFICATION:

"Diploma in Biomedical Sciences" is awarded by the University of Zambia.

1**2.0 CURRICULUM MAP**

	SEMESTER ONE	**CODE**	**Module weight[1]**
1	Cell Biology and Human Genetics	CB151	1.0
2	Applied Chemistry		1.0
3	Applied Physics		0.5
4	Anatomy and Physiology		0.5
5	Applied Mathematics	AM131	1.0
6	Communication Skills and Computers	CC141	1.0
	SEMESTER TWO		
6	Anatomy and Physiology		1.0
7	Analytical techniques and instrumentation	ATI 122	1.0
8	Safety and Ethics		0.5
9	General Microbiology	MM222	1.0
10	Biostatistics, Epidemiology and Research methods	BE142	1.0
11	Biochemistry I	BC152	1.0
	YEAR TWO MODULES		
	SEMESTER ONE		
1	Biochemistry II	BC212	1.0
2	Haematology I	HM211	1.0
3	Immunology	IM221	1.0
4	Pharmacology	PHM231	0.5
5	Medical Microbiology I (Bacteriology)		1.0
6	Histology		1.0
	SEMESTER TWO		
7	Medical Parasitology I	MP241	1.0
8	Pathology		1.0
9	Molecular Biology	MB232	1.0
10	Cellular Pathology I	PTH 242	1.0
11	Blood Transfusion Science I	BTS 252	1.0
	YEAR THREE MODULES		
	SEMESTER ONE		
1	Hospital Placement plus practical project		1.0
	SEMESTER TWO		
6	Laboratory Management (0.5)		0.5
7	Medical Parasitology II (0.5)		0.5
8	Haematology II & Blood Transfusion Science II		1.0
9	Cellular Pathology II	PTH322	1.0
10	Clinical Biochemistry	CBC312	1.0
11	Medical Microbiology II	MM332	1.0

[1] 1.0 =full Semester, 0.5=Half Semester

12.1 MATRIX OF SCHEME OF MODULES

YEAR OF STUDY	SEMESTER I		SEMESTER II	
	Module	Code	Module	Code
I	Cell Biology and Human Genetics	CB151	Anatomy and Physiology	BS 112
	Applied Chemistry	AP 121	Analytical techniques and instrumentation (ATI 122)	ATI 122
	Applied Physics	AM 131	Safety and Ethics	SEM 132
	Anatomy and Physiology	CC 141	Medical Microbiology I (General)	MM222
	Applied Mathematics	AM131	Biostatistics, Epidemiology and Research	BER 142
	Communication Skills and Computers	CC141	Biochemistry I	BC152
II	Biochemistry II	BC212	Medical Parasitology I	MP242
	Haematology I	HM211	Pathology	
	Immunology	IM211	Molecular Biology	MB 232
	Pharmacology	PHM231	Cellular Pathology II	PTH 242
	Medical Microbiology II (Bacteriology)		Blood Transfusion Sciences I	BTS 252
	Histology			
III	Hospital Placement plus practical project		Laboratory Management	LM 311
			Medical Parasitology II	
			Haematology & and Blood Transfusion Science II	
			Cellular Pathology II	PTH 322
			Clinical Biochemistry III	CBC312
			Medical Microbiology III	MMM332

MODULES IN THE FIRST YEAR

SEMESTER ONE

Programme Name	YEAR	Semester #	Course Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**I**	**I**	**Cell Biology & Human Genetics**	CB 151	1.0

AIM:
To equip students with the knowledge of the structure and function of differentiated and non differentiated prokaryotic and eukaryotic cells.

OBJECTIVES:
At the end of the module students, should be able to;-

1. Explain principles of genetic basis of disease.
2. Identify and state the distinguishing features of various cell structures and functions of the body.
3. Elucidate the link between gene mutations and human genetic diseases.
4. Describe the cell cycle and its control.

CONTENT:

1.0. THE PLASMA MEMBRANE:

1.1 Structure and function

1.1.1 Describe the structure, composition and function of the plasma membrane
1.1.2 Draw the fluid mosaic model of plasma membrane structure
1.1.3 Give examples of diseases resulting from faulty plasma membrane function

1.2 Cell communication

1.2.1 Describe the various junctions that bind cells together
1.2.2 Explain the role of various junctions in cell to cell communication

2.0. CELL NUCLEUS (eukaryotic systems)

2.1 Structure and Functions

2.1.1 Distinguish the various structural components of the nucleus
2.1.2 Describe the functions of the nucleus
2.1.3 Explain the transport of macromolecules across the nuclear membrane
2.1.4 Explain the regulation of RNA transcription

3.0. CYTOPLASMIC COMPONENTS:

3.1 The mitochondrion

3.1.1 Describe the structural features of mitochondria

3.1.2 Explain the main functions localised to each compartment of the mitochondrion

3.2 Rough endoplasmic reticulum

3.2.1 Explain the main function of rough endoplasmic reticulum

3.3 Smooth endoplasmic reticulum

3.3.1 Name the feature which distinguishes the SER from RER

3.3.2 Describe the role of smooth endoplasmic reticulum in hydroxylation reactions, drug detoxification, carbohydrate metabolism and synthesis of fats and lipids

3.4 Vacuolar system

3.4.1 Distinguish the various types of vacuoles

3.5 Golgi apparatus

3.5.1 Describe the structure of the golgi apparatus

3.5.2 Explain the functions of golgi apparatus

3.5.3 Establish the interrelation between Endoplasmic reticulum and golgi lysosomes

3.6 Lysosomes

3.6.1 Describe lysosome structure and biogenesis

3.6.2 Explain cellular digestion the main function of lysosomes

3.6.3 Summarise the major diseases which result from deficiency of specific lysosomal enzymes

3.7 Peroxisomes

3.7.1 Describe the structure and biogenesis of peroxisomes

3.7.2 Explain the occurrence and function of animal peroxisomes

3.8 Secretory granules

3.8.1 Explain the role of secretory granules in transportation of material in out of the cell.

4.0. CYTOPLASMIC MATRIX:

4.1 Formed storage products.

4.1.1 Explain the fate of stored glycogen

4.2 Cytoskeleton

4.2.1 Define the cytoskeletal network

4.2.2 Distinguish the three major structural elements of the cytoskeleton

4.2.3 Explain the function of the cytoskeleton

5.0. HUMAN GENETICS

5.1 Historical perspectives

5.1.1 Trace the origins of human genetics

5.1.2 Outline the major contributors to the development of genetics

5.2 Definition of terms

5.2.1 Define terms used in genetics: gene loci; alleles; homozygous, heterozygous diploid, haploid, dominant, recessive, genotype and phenotype

5.3 Human Genome Project

5.3.1 Traces the origins of the human genome project

5.3.2 Review the principle of gene mapping

5.3.3 Appraise the importance of identifying and sequencing genes in the treatment of diseases such as cystic fibrosis, leukaemia, huntington's disease etc.

6.0. OVERVIEW OF CELL CYCLE AND ITS CONTROL

6.1 Simple and complex models

6.1.1 Distinguish between simple and complex models of cell cycle

6.1.2 Explain the variation in cell cycles in terms of length and timing

6.1.3 Describe the regulation of cells cycle: chemical and molecular basis

6.2 Structure and function of chromosomes

6.2.1 Describe the structure and function of chromosome

6.2.2 Explain the chromosome theory of inheritance

6.3 Genes, alleles and linkage

6.3.1 Distinguish between structural genes from regulatory genes

6.3.2 Gene regulation in prokaryotes and in eukaryotes

6.4 Mitosis and meiosis

6.4.1 Describe the process of meiosis

6.4.2 Outline the product of meiosis

6.4.3 State the significance of meiosis

6.4.4 Compare mitosis with meiosis

7.0. CHROMOSOMAL THEORY OF INHERITANCE

7.1 Recombination of unlinked genes

7.1.1 Explain the role of chromosomes in inheritance

7.1.2 Describe segregation and assortment of unlinked genes

7.2 By Human pedigrees and karyotyping

7.2.1 Explain the significance of karyotyping

8.0. GENETICS OF SEX DETERMINATION

8.1 Chromosomal basis of sex

8.1.1 State the significance of sex chromosome

8.2 X-inactivation in females

8.2.1 Explain the process of X chromosome inactivation in female mammals by DNA methylation

8.2.2 Show the presence of inactivated X chromosome by demonstrating a barr body

8.2.3 State the benefit of X inactivation

8.3 Sex linked disorders

8.3.1 Classify sex linked disorders

8.3.2 Describe the importance of sex linked disorders

9.0. CHROMOSOMAL ABERRATIONS

9.1 Alterations of chromosomal structure

9.1.1 Describe diseases associated with alteration in chromosome structure

9.2 Alterations of chromosomal number (e.g. aneuploidy; polyploidy)

9.2.1 Explain the consequences resulting from alteration of chromosome number

9.3 Mutagenesis

9.3.1 Define mutagenesis

9.3.2 Describe the various types of mutations

9.3.3 Explain the consequences of mutation

9.3.4 Describe the principle of AMES test as a test for mutagenesis

10.0. ONCOGENES AND ANTI-ONCOGENES

10.1 Origins and functions

10.1.1 Define oncogenes and anti-oncogenes

10.1.2 Give examples of oncogenic viruses

10.2 Role in cancer

10.2.1 Explain the role of oncogenes and tumour suppressor genes in the development of cancer

TEACHING METHODS AND CONTACT HOURS:

Lectures	3 hour/Wk
Practicals	3 hour/Wk
Tutorials	1 hour/Wk

ASSESSMENT

Continuous Assessment. 40%

- Tests 20 %
- Assignments 15 %
- Practical reports 5 %

Examination 60%
(Written only)

Prescibed text book

Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J.D. (1994). Molecular Biology of the Cell, (3rd Edition). Garland Publishing Inc., New York.

Hopkins, R.C. (1978) Structure and Function of Cells. W. B. Saunders London.

Recommended books:

Griffith et al. (1993) An introduction to genetic analysis 5th edition. WH Freeman and Co. NY

Connor and Ferguson – Smith (1993) Essential medical genetics 4th Ed. Blackwell Scientific, Oxford.

Cumming M. (1994) Human Hereditary principles and issues 3rd Ed. St. Paul.

Programme Name	YEAR	Semester #	Course Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**I**	**I**	**Applied Chemistry**	AC 111	1.0

AIMS

To equip students with basic concepts of chemistry focusing on the relationships between structure and function of the chemical components of living things as applied to Biomedical Sciences

OBJECTIVES

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

1. Recognise that a living thing, e.g. a human being, is simply an organised, operating collection of organic and inorganic chemicals.
2. Explain how chemistry interfaces with biomedical sciences
3. Perform basic stoichiometric calculations.
4. Identify basic physical processes and chemical changes occurring in living things.
5. Perform basic procedures in handling simple laboratory equipment/glassware and data.

CONTENT

1.0 Basic Priciples and concepts

1.1 Measurements

1.1.1Name mass, volume, temperature and density as the most common quantities requiring measurement in chemistry.

1.1.2State the units of volume, mass, temperature and density and their interconversions.

1,1,3Explain accuracy and precision.

2.0 Introduction to Laboratory Apparatus and Equipment

Identify and state the use of common chemistry laboratory glassware.

Identify and state the use of common chemistry laboratory equipment.

3.0 Matter and Atomic Structure

Describe the three states of matter and their interconversion.

State the chemical composition of the human body as mainly composed of carbon, oxygen, nitrogen and hydrogen.

State other chemical elements required for the normal function of the human body other than those in 3.2.

Define an atom.

Describe the major subatomic particles of an atom, namely: protons, neutrons, and electrons.

Define the term isotopes and explain their use in medicine and research.

Explain the terms ion, elements, molecules, compounds and mixtures.

Recall chemical symbols of elements.

Use the periodic table to explain atomic number, mass number

Elementary treatment of groups and periods on the periodic table

4.0 Formulas, chemical equations, gas laws, and stoichiometry

Write chemical formulas of compounds.

Write balanced chemical equations.

Calculate relative molecular mass.

Determine empirical and molecular formulas from percentage composition.

Define the mole, molarity, and Avogadro's constant.

Basic stoichiometric calculations involving reacting masses and volumes of gases; calculate molarities from given data.

Explain Boyle's and Charles' Laws.

Basic calculations on Boyle's and Charles' Laws.

5.0 Chemical Bonding

Describe covalent, ionic, and dative bonding using dot and cross diagrams.

List characteristics of ionic and covalent compounds.

Explain hydrogen bonding in water.

6.0 Organic Chemistry

Define organic chemistry and explain its importance in Biomedical Sciences.

Explain the structures of simple organic compounds.

State the functional groups of open chair (aliphatic), organic compounds, hydrocarbons, halogens (alkyl halides), alcohols, aldehydes, ketones, carboxylic acids, esters, ethers, and amines.

Using IUPAC nomenclature, name the simple organic compounds with functional groups stated in 3.

Define isomers and explain basic chain isomerism, optical isomerism, and geometrical isomerism.

Hydrocarbons

6..1. Define hydrocarbon and identify the different classes of hydrocarbon.

6..2. Define general physical and chemical properties of hydrocarbons.

6..3. Distinguish between saturated and unsaturated hydrocarbons.

6..4. Explain what an aromatic hydrocarbon is using benzene as an example.

Alkyl halides

6..1. Define alkyl halides and give examples of structures of some alkyl halides useful for medical purposes such as chloroform and ethyl chloride

Amines and derivatives

6..1. Give examples of structures of named amino acids and amines
6..2. Define amines and amino acids
6..3. Explain and illustrate how amino acids are interconnected via peptide bonds to form proteins

Ethers

6..1. Describe what ethers are
6..2. Give the structure of an ether, e.g. diethyl ether and state its medical use

Esters

6..1. Define esters and explain their formation from organic acids and alcohols.
6..2. Illustrate the structure of esters using ethyl ethanoate

Carboxylic acids

6..1. Define carboxylic acids
6..2. Illustrate the structure of acids using formic acid, lactic acid, and acetic acid
6..3. Name acids of biological importance

Aldehydes and ketones

6..1. Define and describe aldehydes and ketones
6..2. Outline the difference between aldehydes and ketones
6..3. Simple structures of aldehydes and ketones
6..4. Explain the clinical significance of acetone in urine of a patient
6..5. The use of formaldehyde (formulation)

Alcohols and phenols

6..1. Describe alcohols and phenols
6..2. Draw structures of alcohols and phenols
6..3. Outline the importance of alcohols and phenols as antiseptics

Introductory Biochemistry

6..1. Define biochemistry
6..1.1. List the biochemicals common to all living systems as lipids, carbohydrates, proteins, enzymes, vitamins, hormones, nucleic acids and ATP.
6..2. Carbohydrates
6..2.1. State that carbohydrates have three elements: carbon, monosaccharaides, oligosaccharides and polysaccharides
6..2.2. Classify carbohydrates as monosaccarides, oigosaccharides, and polysaccharides
6..2.3. Identify structures of classes in 16.14.2.2
6..3. Lipids

6..3.1. Define and classify lipids as simple lipids, compound, lipids and steriods.
6..3.2. Illustrate structures of lipids using oleic acid and cholesterol.
6..3.3. Explain the importance of lipis

6..4. Proteins
6..4.1. Define proteins
6..4.2. Explain the structure of proteins and amino acids

6..5. Nucleotides
6..5.1. Explain a nucleotide and its three units
6..5.2. Identify structures of te three units of 6.14.5.1
6..5.3. Explain the chemical terms and structures of DNA and RNA

7.0 OXIDATION-REDUCTION REACTIONS

Define oxidation and reduction; Give examples of oxidising and reducing agents

Explain oxidation number

Illustrate oxidation and reduction in biological processes using chemical equations.

8.0 ACIDS, BASES, SALTS AND BUFFERS

Define an acid, a base, and a salt.

Outline properties of acids and bases.

Define and explain the difference between a conjugate acid and a conjugate base.

Give examples of salts of biological importance.

Name the acids found in a human body.

Define pH in terms of hydrogen ion concentration and describe the pH scale

Calculate the pH of a solution given its hydrogen ion concentration.

Define a buffer solution.

Explain the effect of pH on physiology processes in the body.

Identify and explain the function of the physiological buffers in the body.

State the pH values of some important body fluids.

9.0 ENERGY AND CHEMICAL REACTIONS

Define energy and its unit of measurement.

Describe enthalpy change in terms of exothermic and endothermic reactions.

Represent energy changes by energy profile diagrammes for catalytic reactions.

Illustrate exothermic and endothermic reactions using chemical equations of photosynthesis and respiration.

Appreciate that energy from biological oxidation stored in form of Adenosine Trinucleotide Phosphate (ATP).

Explain the rate of a chemical reaction.

Describe factors that affect the rate of a chemical reaction.

Explain the function of a catalyst.
Name the biological catalyst found in a human body.
Explain the state of chemical equilibria using Le Châtelier's Principle.

10.0 SOLUTIONS AND OSMOSIS

Explain the terms: solute, solvent, solution, and suspension.
Describe sedimentation, emulsions, solubility, and electrolytes.
Explain specifications of concentrations of solutions:

10..1. Percentage solutions: (1) grams of solute per 100ml of solution (*w*/*v*); (2) Grams of solute per 100g of solution (*w*/*w*); (3) ml of solute per 100ml of solution (*v*/*v*)
10..2. Molar solutions as being based on the number of moles of solute per 1000 ml (1 liter) of solution.
10..3. Prepare solutions as specified in 10.3.1 and 10.3.2.

Diffusion and Osmosis

10..1. Explain diffusion, osmosis, and osmotic pressure
10..2. Outline the importance of osmotic pressure illustrated by a clinical condition.

TEACHING METHODS AND CONTACT HOURS

Lectures	3 hours/week
Practical	3 hours/week
Tutorial	1 hour/week

ASSESSMENT:

Continuous Assessment	40 %	
• Tests	15 %	
• Assignments	10 %	
• Practical reports		15%
Examination (Written only)	60 %	

PRESCRIBED BOOKS

1. Ramsden, E.N. (1994), 3rd Ed. A-level Chemistry. Stanley Thorns Ltd, UK.

RECOMMENDED BOOKS

1. Fulick, P (1994), Chemistry. Heinemann Educational Books Ltd. Oxford.
2. Morrison, B. (1994), Organic Chemistry. Prentice-Hall International, London.
3. Banda, S.F. and Kumar, G (1995), Introductory Chemistry (Part I and II). University of Zambia.
4. Plummer, D.T. (1987). An Introduction to Biochemistry.
5. Toporek, M. Basic Chemistry of Life. Appleton. New York.

Programme Name	YEAR	Semester #	Course Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**I**	**I**	**Applied Physics**	**AP 1- 1**	**0.5**

AIM
To provide students with specific physics knowledge and skills necessary in Biomedical Sciences disciplines.

OBJECTIVES
By the end of the course, the student should be able to:

1. Understand basic principle of applied physics used in Biomedical Sciences.
2. Explain structural and thermal properties of matter.
3. Demonstrated understanding of terms, concepts and principles of physics related to electricity and magnetism, optics, and waves applicable in instrumentation.

CONTENT

1.0 Mechanics

1.1. Standard Measurements and Units

1.1.1. Define physical quantities, giving the magnitude of such quantities as the product of a number and a unit.

1.1.2. Use symbols to define physical quantities, giving the meaning for the symbol.

1.1.3. Describe base quantities and units of the Systéme d'Unites Internationale (S.I.) – the base quantities being: Length, mass, time, current, temperature interval, amount of substance and luminous intensity.

1.1.4. Define the base units: metre, kilometre, second ampere, kelvin, and mole.

1.1.5. Show the relationships between derived units and fundamental units using dimensional analysis.

1.2. Vectors and Scalars

1.2.1. Define vectors and scalars

1.2.2. Describe the relation between vectors and scalars

1.2.3. Explain the concept of vector addition, difference, and scalar multiplication.

1.3. Linear, circular and rotational motion.
    1.3.1. Define motion
    1.3.2. Describe the various types of motion: linear, circular and rotational
    1.3.3. Explain the terms: linear velocity, angular velocity, linear acceleration and angular acceleration.
    1.3.4. Use the equations of uniformly accelerated linear, circular and rotational motion to calculate linear and angular displacement, linear and angular velocity

1.4. Torque
    1.4.1. Define and describe torque
    1.4.2. Define and describe moment of a force about a point as a 1-dimensional torque

1.5. Equilibria, Centre of Mass, and Centre of Gravity
    1.5.1. Explain the concept of equilibrium of a body and locate
    1.5.2. Define and locate centre of mass of a body
    1.5.3. Define and locate centre of gravity of a body
    1.5.4. Explain the relationship between centre of mass and centre of gravity of a body

1.6. Work, Energy and Power
    1.6.1. Define work, energy, and power
    1.6.2. Explain the principle of conservation of energy

1.7. Pressure in Liquids and Gases
    1.7.1. Define the term pressure
    1.7.2. Relate the differences in pressure between liquids and gases
    1.7.3. Practical application of pressure of liquids and gases in industry and biomedical sciences

2.0 Thermal Properties of Matter

2.1. Thermometry
    2.1.1. Explain the concept of thermal equilibrium, temperature, and temperature scale
    2.1.2. Describe different types of thermometers, i.e. mercury in glass and thermocouples

2.2. Heat Transfer and Calorimetry
    2.2.1. Describe qualitatively the transfer of thermal energy by conduction, convection, radiation and evaporation
    2.2.2. Explain the concepts of heat capacity, specific heat capacity
    2.2.3. Calculate the quantity of energy transfer in calorimetry
    2.2.4. Identify experimental sources of error in calorimetry

2.3. Thermal conductivity
- 2.3.1. Describe thermal conductivity in 1-dimensional only in materials placed end-to-end and placed parallel-sided
- 2.3.2. U-values of materials
- 2.3.3. Numerical examples illustrating thermal conductivity in 1-dimension only

2.4. Kinetic Theory of Gases
- 2.4.1. Describe Brownian motion in gases
- 2.4.2. Outline the assumptions in the Kinetic Theory of Gases
- 2.4.3. Explain the Ideal Gas Equation of State
- 2.4.4. Apply the Ideal Gas Equation of State in numerical problems
- 2.4.5. Define vapour and describe the properties

2.5. Thermodynamics
- 2.5.1. Explain the relationship between heat, work and internal energy of a system
- 2.5.2. Explain adiabatic, isothermal and isochoric transformations
- 2.5.3. State the Zeroth and First Laws of Thermodynamics
- 2.5.4. Explain enthalpy (H) in relation to the First Law of Thermodynamics
- 2.5.5. Explain entropy (S) in relation to the 2^{nd} Law of Thermodynamics
- 2.5.6. Describe the Carnot Cycle in terms of (P-V curve or a T-S curve)
- 2.5.7. Describe application of the Carnot cycle in Biomedical Sciences

3.0 Electricity and Magnetism

3.1. Electrostatics
- 3.1.1. Describe quantitatively Coulomb's Law of Electrostatics
- 3.1.2. Explain the distinction between conductors and insulators
- 3.1.3. Explain the relationship between electrostatics and electrodynamics

3.2. Current Electricity
- 3.2.1. Define electric current and potential difference
- 3.2.2. State Ohm's Law
- 3.2.3. Explain the concept of resistance and resistivity
- 3.2.4. Apply formulae for resistors in series and in parallel in simple circuit calculations
- 3.2.5. Explain the practical importance of the principle of potential divider in some instruments used in Biomedical Sciences

3.2.6. State the formulae for power in an electric circuit: $P = VI$; $P = I^2R$; $p = V^2/R$ and describe the heating effect of an electric current
3.2.7. The uses of cells and accumulators in instruments used in Biomedical Sciences
3.2.8. Define and describe electrolysis

3.3. Alternating current
3.3.1. Explain the term single-phase alternating current and sketch the graph of variations of current with time and voltage with time as a periodic sine curve
3.3.2. Explain the terms associated with alternating current: cycle, frequency, period, peak, instantaneous value, average value, and root-mean-square (rms) values
3.3.3. Explain the relationship between peak values, average values, and root mean square values
3.3.4. Define resistance, inductive reactance, capacitive reactance, and impedance in alternating (a.c.) circuits
3.3.5. Describe the magnetic effect of an electric current

3.4. Magnetism
3.4.1. Explain the concept of a magnetic field
3.4.2. Describe magnetic fields by lines of forces
3.4.3. Explain paramagnetism and diamagnetism in terms of atoms or ions as tiny magnets
3.4.4. Explain motion of charges in electromagnetic fields

4.0 Geometrical Optics

4.1. Rectilinear Propagation of Light
4.1.1. Explain the principle that light travels in a straight line
4.1.2. Define and describe reflection (regular and diffuse) and refraction at place interfaces
4.1.3. Explain total internal reflection and its applications
4.1.4. Explain Snell's Law and refractive index
4.1.5. Explain critical angle and its relationship with refractive index
4.1.6. Describe optical fibre systems: Step index multimode and monomode fibres
4.1.7. Describe practical applications of principles of fibre optics

4.2. Lenses
4.2.1. Describe different types of lenses (convergent and divergent)
4.2.2. Define terms related to lenses: principal focus, centre of lens, radius of curvature, principal axis and centre of curvature and focal length
4.2.3. Describe formation of images in lenses

4.2.4. Explain the use of lenses in optical instruments commonly found in Biomedical practice

5.0 Wave Properties of Light

5.1. Basic properties
- 5.1.1. Describe light waves as propagation of energy
- 5.1.2. Describe progressive waves graphically and explain related terms: amplitude, speed, wavelength, frequency, and phase
- 5.1.3. Describe light as an electromagnetic wave consisting of electric and magnetic components at right angles to each other
- 5.1.4. Description of the electromagnetic spectrum

5.2. Wave phenomenon of light
- 5.2.1. Explain the principle of superposition of waves
- 5.2.2. Explain the terms; phase difference and path difference
- 5.2.3. Describe and explain interference of light
- 5.2.4. Describe and explain diffraction of light
- 5.2.5. Explain the conditions for diffraction and interference to occur
- 5.2.6. Explain the application of wave phenomena in imaging in Biomedical Sciences

6.0 Sound Waves

6.1. Explain propagation of sound waves in a medium

6.2. Explain resonance of sound waves

6.3. Doppler effect in sound
- 6.3.1. Describe the principle of the Doppler effect in the ultrasound applications in Biomedical Sciences

TEACHING METHODS AND CONTACT HOURS

Lectures	3 hours/week
Practical	3 hours/week
Tutorial	1 hour/week

ASSESSMENT:

Continuous Assessment	40 %
• Tests	15 %
• Assignments	10%
• Practical reports	15%
Examination (Written only)	60 %

Programme Name	YEAR	Semester #	Course Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**I**	**I**	**Anatomy & Physiolgy I**	**AAP**	0.5

Aims

To equip the student with the knowledge of the fundamental approaches in the study of the normal human body and its functions as the basis for understanding pathophysiologic changes.

Objectives

By the end of the module the student should be able to:

1. Describe the normal microscopic anatomy of the cell and the basic tissues of the body in relation the functions.
2. Identify the normal tissues in stained slide preparations.
3. Use the knowledge of anatomy to explain the normal physiological processes of the human body

CONTENT

1.0 Principles of Anatomy

1.1 Methods of study

1.1.1 Identify and describe the various methods used in the study of anatomy

1.1.2 Explain the relative adavanatges and disadvanatages of each method

1.2 Hierarchy of organisation

1.2.1 Describe how anatomical systems are organised

1.2.2 Use diagrammatic illustrations to show the heirachy of organisation

1.3 Descriptive nomenclature

2.0 Cytology

2.1 Structure of the cell

2.2 Cell Division

2.3 Homeostatic mechanisms

3.0 Formation

3.1 Derivatives of germ layers and establishment of body form

3.2 Derivatives of ectoderm, mesoderm and endoderm.

3.3 Formation of head, tail, and lateral body folds

4.0 Epithelial tissue
4.1 Covering
4.2 Lining
4.2 Glandular

5.0 Connective tissue
5.1 Cells and Fibres
5.2 Extracellular matrix
5.3 Classification of connective tissues
5.4 Bone and Cartilage

6.0 Muscle tissue
6.1 Skeletal muscle
6.2 Cardiac muscle
6.3 Smooth muscle
4.0 Applied physiology

7.0 Nervous tissue
7.1 Development if nerve tissue
7.2 Structure of cells of the nervous system
7.3 Divisions of the nervous system
7.4 Applied physiology

8.0 Blood
8.1 Formed elements
8.2 Haemopoiesis

Teaching methods and contact hours:
- Lectures 3 hour/Wk
- Tutorials 1 hour/Wk
- Practicals 3 hour/Wk

Assessment
Continuous assessment 40 %
- Tests 25 %
- Assignments 15 %

Examination 60 %
(Written only)

Prescribed books
1. Williams, P.L., Warwick, R., Dyson,M. and Bannister, L.H.Eds. (1989).Gray's Anatomy, 37th Edition, Churchill Livingstone/ISE, Edinburgh.
2. Guyton, A.C. (1993). Textbook of Medical Physiology. WB Saunders Co, Philadelphia.

Recommended books

1. Tortora, G.J., Grabowski, S.R, (2000). Principles of Anatomy and Physiology, 9th Ed. John Wiley and Sons, Inc., New York.
2. Chaurasia, B.D.(1995), Human Anatomy; Regional and Applied (3 Vols.) 3rd edition. CBS Publishers, New Delhi.

Programme Name	YEAR	Semester #	Course Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**I**	**I**	**Applied Mathematics**	**AM 1-1**	1.0

AIM

To provide students with the basic Mathematical knowledge and computational skills necessary for application in various in biomedical science disciplines.

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

1. Make accurate measurements using S.I. (MKS) and CGS units, as well as utlize an electronic calculator;
2. Use appropriate algebraic functions to interpret population growth, convert sizes and weights and related quantities;
3. Plot graphs expressing relationships between measurable variables;
4. Develop an understanding of the uses of calculus and matrices in solving a variety of mathematical problems in biomedical sciences.

CONTENT

1.0 Measurements

1.1. Approximation and accuracy

1.1.1. Round off numbers to a given number of significant figures, or decimal places
1.1.2. Write small or large numbers in scientific notation
1.1.3. Determine absolute and relative errors in measurements
1.1.4. Explain the Rules of error bounds in basic mathematical operations such as addition, subtraction, multiplication, and division.
1.1.5. Discuss types of measurement scales (categorical, ordinal, interval, and ratio)
1.1.6. Use the scientific calculator correctly and efficiently
1.1.7. Describe the S.I. units for length, area, volume, mass, temperature, current, and quantity of matter measurements
1.1.8. Explain and compute the multiple and sub-multiple of units (giga, mega, kilo, deci, cent, milli, micro, nano, and pico).

2.0 Algebra

2.1. Numbers and number systems

2.1.1. Discuss types of numbers (complex, real, even, odd, integer, prime, rational, and irrational)
2.1.2. Discuss types of number systems (decimal, binary, etc.)
2.1.3. Convert numbers from one system to the other
2.1.4. Add, subtract, multiply numbers in different number systems

2.2. Fractions

2.2.1. Explain the different types of fractions
2.2.2. Convert manually fractions from one form to another
2.2.3. Add, subtract, multiply and divide fractions manually

2.3. Linear equations

2.3.1. Solve linear equations in one variable
2.3.2. Solve systems of linear equations in 2 variables by using sustitution, method of elimination, and graphical method.

2.4. Quadratic equations and inequalities

2.4.1. Draw Graph of quadratic functions
2.4.2. Solve quadratic equations by analytical method and graphical method
2.4.3. Compute the roots of a quadratic equation
2.4.4. Solve quadratic inequalities
2.4.5. Represent quadratic inequalities using graphic representation

2.5. Polynomials

2.5.1. Factorise polynomials
2.5.2. Apply the Remainder Theorem in determining quotient, remainder, and roots of a polynomial
2.5.3. Apply the Factor Theorem to determine unknown coefficients and parameters in a polynomial

2.6. Indices

2.6.1. Describe the Laws of Indices
2.6.2. ApplyLaws of Indices to simple products, quotients involving rational indices
2.6.3. Solve indicial equations

2.7. Logarithmic and exponential functions

2.7.1. Define logarithm of a number
2.7.2. Compute the Logarithm to base ‘e’ and 10 and any other base
2.7.3. Sate the Laws of logarithm
2.7.4. Solve problems involving exponential functions
2.7.5. Solve problems involving logarithm functions
2.7.6. Draw graphs of logarithm and exponential functions

3.0 Functions

3.1. Mapping

3.1.1. Explain ‘mapping’
3.1.2. Draw arrow diagrams
3.1.3. Describe a 1-1 mapping
3.1.4. Define of a function

3.2. Algebraic functions

3.2.1. Show the meaning of a Functional notation
3.2.2. Evaluate a function
3.2.3. Determine the range of a function given its domain
3.2.4. Illustrate Inverse functions
3.2.5. Representation function and its inverse using a graph
3.2.6. Illustrate Rational functions
3.2.7. Resolve rational functions into partial fractions (Types 1, 2, and 3)

4.0 Coordinate geometry

4.1. Cartesian coordinates of 1- and 2-dimensional planes

4.1.1. Plot points on the 2-dimensional Cartesian plane
4.1.2. Determine of coordinates of a plotted point on the Cartesian plane

4.2. Coordinate geometry of a straight line

4.2.1. Compute the Gradient of a straight line
4.2.2. Determine the equation of a straight line
4.2.3. Illustrate Conditions for parallelism and perpendicularity of straight lines
4.2.4. Calculate distance between two points
4.2.5. Calculate distance of an external point from a line

4.3. Coordinate geometry of a circle and a parabola

4.3.1. Determine the equation of a circle
4.3.2. Determine the centre of a circle
4.3.3. Determine the equation of a parabola
4.3.4. Draw a circle or parabola given its equation

4.4. Vector algebra

4.4.1. Distinguish between scalar and vector quantities
4.4.2. Add and subtract vectors
4.4.3. Define a unit vector
4.4.4. Solve vector problems by using vector components and unit vectors
4.4.5. Show the Scalar multiplication of a vector
4.4.6. Evaluate scalar and vector product of 2 coplanar vectors
4.4.7. Compute the magnitude of a vector

5.0 Trigonometric function

5.1. Radians

5.1.1. Convert radians to degrees and vice versa

5.2. Arc and sector

5.2.1. Define an arc and sector
5.2.2. Calculate length of an arc
5.2.3. Calculate area of a sector

5.3. Trigonometric ratios

5.3.1. Calculate Trigonometric ratios of sine, cosine, and tangent
5.3.2. Solve problems involving trigonometric ratios

5.4. Numeric trigonometry

5.4.1. Solve simple trigonometric equations in the form: sin$x$ = φ, cos$x$ = q, tan$x$ = υ in a given range

5.4.2. Formulae for sin (A ± B); cos (A ± B)

5.4.3. Convert $a$sin$x$ ± $b$cos$x$ in the form Rsin(x + y) or Rcos(x + y)

5.4.4. Solve the equations of the form $a$sin$x$ + $b$cos$x$ = p

6.0 Differentiation

6.1. Limits

6.1.1. Show the Concept of limits of sequences and functions

6.2. Gradient of a curve

6.2.1. Calculate the gradient of a curve at a given point

6.3. Differentiation from first principles

6.3.1. Differentiate function of the X^n where $0 < n \leq 3$ using first principles

6.4. Rules of differentiation

6.4.1. Differentiate sum, difference, product and quotient of a function

6.4.2. Differentiate function of function

6.4.3. Differentiate trigonometric functions of the form sin$x$, cos$x$, and tan$x$

6.4.4. Use Implicit differentiation

7.0 Integration

7.1. Indefinite integrals

7.1.1. Integrate simple algebraic function of the form X^n where n is rational and $n \neq -1$

7.1.2. Show the Methods of integration (substitution method) and use of partial fractions

7.1.3. Integrate simple trigonometric functions of the form cos$x$, sin$x$, and tan$x$

7.1.4. Integrate simple exponential functions of the form $e^{f(x)}$

7.2. Definite Integrals

7.2.1. Evaluate definite integrals

7.2.2. Calculate areas under curves using definite integrals

7.2.3. Use Other methods of calculation of approximate areas under curves (trapezoidal rule, Simpson's rule)

8.0 Application of calculus

8.1. Linear motion and non-linear motion

8.1.1. Use calculus to calculate displacement, velocity and acceleration of uniformly accelerated motion and motions with variable acceleration

8.1.2. Use calculus to calculate Small changes in functions and approximation

8.2. Maxima and minima of functions

8.2.1. Use calculus to determine stationary points on a curve

8.2.2. Distinguish between kinds of stationary points (maximum and minimum) as turning points

9.0 Matrices

9.1. Element

9.1.1. Describe a matrix
9.1.2. Represent data in matrix form
9.1.3. Explain the meaning of an element of a matrix

9.2. Order

9.2.1. Determine the order of a matrix
9.2.2. Solve Square matrices (n x n ; $1 < n \leq 3$)

9.3. Algebra of matrices

9.3.1. Work out the Sum, differences, product, scalar multiplication of matrices
9.3.2. Compute a Null matrix
9.3.3. Identity matrix

9.4. Determinant and inverse of a matrix

9.4.1. Calculate the determinant of a matrix
9.4.2. Transpose a matrix
9.4.3. Adjoint of a matrix
9.4.4. Compute the Inverse of an n x n square matrix where $1 < n \leq 3$
9.4.5. Solve of a system of linear equations of order n (where $1 < n \leq 3$) by matrix method

TEACHING METHODS AND CONTACT HOURS

Lectures	3 hours/week
Practical	2 hours/week
Tutorial	1 hour/week

ASSESSMENT:

Continuous Assessment	60 %	
• Assignments and tests	40 %	
• Tutorial exercises		20%
Examination (Written only)	40 %	

PRESCRIBED BOOKS

Greer A. and Taylor G.W. (1994) BTEC First Mathematics for Technicians. Stanely-Thornes Ltd London.

RECOMMENDED BOOKS

Clarke, L.H. and Norton, F.G.J. (1984) Ordinary Level Mathematics (7th Edn) Heinemann Educational Books Ltd. Oxford.

Programme Name	YEAR	Semester #	Course Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**I**	**I**	**Communication skills and computing**	**CC 1-1**	1.0

AIM:

To equip the student with study and communication and computer literacy skills for the laboratory and the hospital environment.

OBJECTIVES:

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

- Show skills in learning and time management.
- Communicate effectively with both colleagues and patients
- Use a personal computer effectively for learning and occupational purposes.

CONTENT:

1.0. STUDY SKILLS

1.1. Introduction to Study Skills

1.1.1. Identify the different types of learners
1.1.2. Understand differences in learning strategies
1.1.3. Understand traditional study skills and educational uses of information technology

1.2. Reading

1.2.1. Explain the process of achieving good reading skills
1.2.2. Describe the different types of reading:
   a) Browsing
   b) Scanning
   c) Speed reading
   d) Study reading
1.2.3. Identify common faults in reading

1.3. Seeking information

1.3.1. Explain the role of constant reference, thorough reading and general reading
1.3.2. Explain the role of library information seeking
1.3.3. Explain the use of periodicals
1.3.4. Explain the role of electronic tools in information seeking

2.0. COMMUNICATION

2.1. Nature of Communication

2.1.1. Define communication
2.1.2. Explain the concept of sender , receiver and noise in communication
2.1.3. Understand the process of communication
2.1.4. Describe various forms and contexts of communication
2.1.5. Identify barriers to effective communication and problem-solve how to overcome them

2.2. Non Verbal Communication

2.2.1. Identify types of non verbal communication
2.2.2. Explain the advantages and disadvantages of non verbal communication
2.2.3. Demonstrate appropriate non verbal communication

2.3 Verbal Communication

2.3.1 Explain advantages and disadvantages of verbal communication
2.3.2 Apply good listening skills
2.3.1 Exhibit effective public presentation skills
2.3.2 Apply effective interviewing skills
2.3.3 Understand the role of oral communication in the workplace

2.4 Written Communication

2.4.1 Understand principles of effective written communication
2.4.2 Explain the advantages and disadvantages of written communication in a work place
2.4.3 Understand the importance of using and acknowledging sources of information
2.4.4 Develop written communication for workplace-relevant purposes (essays, letters, reports)

2.5 Organizational Communication

2.5.1 Display effective interpersonnel communication in the workplace
2.5.2 Identify structure and channels of communication
2.5.3 Demonstrate ability to work in teams and network effectively
2.5.4 Provide good customer service

Commented [PR1]: Library topic removed due to coverage earlier in the unit.

3.0. INTRODUCTION TO INFORMATION TECHNOLOGY

3.1. Personal computers

3.1.1. Define personal computer, hardware and software
3.1.2. Describe typical PC specifications
3.1.3. Identify the elements of the information processing cycle (i.e., input, process, output, and storage)

3.1.4. Identify types of computer storage devices

3.2. Operating Systems

3.2.1. Describe Operating System structure i.e. system components, operating-system services, system programs, system clock
3.2.2. Work within and across multiple Windows
3.2.3. Control appearance of a Window
3.2.4. Perform basic file operations: open, close, delete, move,
3.2.5. Create directories and sub-directories
3.2.6. Use storage devices: discs, tapes, CDs
3.2.7. Use various system utilities and configuration of a PC operating system
3.2.8. Use backup procedures
3.2.9. Install and configure a PC based operating system
3.2.10. Discuss key functions of systems software

3.3. Basic operations and keyboard skills

3.3.1. Input data using a keyboard
3.3.2. Describe uses of a screen
3.3.3. Use a mouse
3.3.4. Use function keys

4.0. COMPUTER OPERATIONS

4.1. Word Processing

4.1.1. Retrieve existing documents
4.1.2. Save documents
4.1.3. Copy text
4.1.4. Create documents (e.g., letters, memos, reports) using existing forms and templates
4.1.5. Safeguard documents using name and save functions
4.1.6. Format text using basic formatting functions (e.g., page setup, tabs, bullets, page numbers, font enhancements, cut and paste)
4.1.7. Check documents using print preview functions
4.1.8. Locate/replace text using search and replace functions
4.1.9. Create new word processing forms, style sheets, and templates
4.1.10. Employ word processing utility tools (e.g., spell checker, grammar checker, thesaurus)
4.1.11. Create tables using table functions (e.g., setup, formatting, editing)
4.1.12. Create columns using column functions (e.g., setup, formatting, editing)
4.1.13. Create outlines
4.1.14. Create footnotes and endnotes
4.1.15. Create macros
4.1.16. Run macros
4.1.17. Assemble documents using merge functions (e.g.,

merge address files with letters and envelopes)

4.1.18. Format text using advanced formatting features (e.g., headers/footers/dropped caps, indexing)

4.1.19. Print materials using print functions (e.g., number of copies, duplexing or one-sided, selected pages or whole document)

4.1.20. Verify accuracy of output

4.1.21. Edit documents

4.1.22. Access needed information using word processing help screen

Integrate word processing with other applications

4.2. Spreadsheets

4.2.1. Design a spreadsheet in accordance with written and/or oral specifications

4.2.2. Create spreadsheets

4.2.3. Retrieve existing spreadsheets

4.2.4. Check spreadsheets using print preview functions

4.2.5. Format spreadsheets using basic formatting functions (e.g., page setup)

4.2.6. Perform calculations using simple formulae

4.2.7. Edit spreadsheets

4.2.8. Create charts and graphs from spreadsheets

4.2.9. Group worksheets

4.2.10. Delete within spreadsheets

4.2.11. Move/copy within spreadsheets

4.2.12. Input/process data using spreadsheet functions

4.2.13. Improve spreadsheet display using enhancement features

4.2.14. Protect data using spreadsheet protection features

4.2.15. Record macros

4.2.16. Run macros

4.2.17. Troubleshoot spreadsheet problems

4.2.18. Apply advanced spreadsheet formulae

4.2.19. Create spreadsheet solutions to biomedical problems

4.2.20. Make "what if—" biomedical decisions using spreadsheets as a tool

4.2.21. Save spreadsheets

4.2.22. Access needed information using online help features

4.2.23. Print spreadsheets

4.2.24. Integrate spreadsheets with other applications

4.3. Data bases

4.3.1. Design a simple database in accordance with written and/or oral specifications

4.3.2. Create and save a database table

4.3.3. Edit the design of a database table

4.3.4. Edit the content of a database table (e.g. add, delete, and modify records)
4.3.5. Search a table to locate records
4.3.6. Sort data in a single field
4.3.7. Enter data using a form
4.3.8. Create/modify a form
4.3.9. Perform single- and multiple-table queries (e.g., create, run, save)
4.3.10. Create calculated fields
4.3.11. Generate customized reports for database files
4.3.12. Process data using database functions (e.g., structure, format, attributes, relationships, and keys)
4.3.13. Locate/replace data using search and replace functions
4.3.14. Print forms, reports, and results of queries
4.3.15. Verify accuracy of output
4.3.16. Add/remove filters
4.3.17. Index files
4.3.18. Create sub-forms
4.3.19. Create graphs
4.3.20. Alter the appearance of a form by adding objects or properties
4.3.21. Design a database to meet the needs of an actual situation or a biomedical problem
4.3.22 valuate database design and functionality
4.3.22. Import, export and work with external data
4.3.23. Integrate relational databases with other applications

4.4. Statistical packages

4.4.1. Enter data (or import) into a statistical package
4.4.2. Analyse data using a statistical package
4.4.3. Construct charts and graphs
4.4.4. Change graph/chart resolution
4.4.5. Prepare statistical reports

5.0. NETWORK UTILITIES

5.1. e-mail

5.1.1. Identify available e-mail systems and the characteristics/features of each
5.1.2. Use contamination protection strategies for e-mail
5.1.3. Access e-mail system using login and password functions
5.1.4. Access e-mail messages received
5.1.5. Access e-mail attachments
5.1.6. Create e-mail messages in accordance with established business standards (e.g. grammar, word usage, spelling, sentence structure, clarity, e-mail etiquette)
5.1.7. Send e-mail messages

5.1.8. Assign priority levels to messages
5.1.9. Create distribution lists
5.1.10. Employ e-mail options such as "reply requested" and "out-of-office reply"
5.1.11. Reply to e-mail messages
5.1.12. Forward e-mail messages
5.1.13. Attach documents to messages
5.1.14. Create folders for organizing messages and documents
5.1.15. Save e-mail messages/attachments
5.1.16. Delete e-mail messages
5.1.17. Print e-mail messages/attachments
5.1.18. Access needed information using e-mail help facilities and tools

5.2. Internet

5.2.1. Identify the key characteristics of the Internet
5.2.2. Trace the development of Internet technology
5.2.3. Identify current issues related to the Internet
5.2.4. Identify services and tools offered on the Internet
5.2.5. Identify the specific strengths, weaknesses, and special features of available search engines
5.2.6. Identify current uses and applications of the Internet
5.2.7. Connect to the Internet
5.2.8. Test Internet connection
5.2.9. Install Internet software
5.2.10. Explore browser features
5.2.11. Download free software upgrades and shareware from the Internet
5.2.12. Unpack files using compression software
5.2.13. Use virus protection techniques
5.2.14. Access business and technical information using the Internet
5.2.15. Select search engine(s) to use
5.2.16. Select appropriate search procedures and approaches
5.2.17. Locate information using search engine(s)
5.2.18. Navigate web sites using software functions (e.g. Forward, Back, Go To, Bookmarks)
5.2.19. Evaluate Internet resources (e.g., accuracy of information)
5.2.20. Access library catalogues on the Internet
5.2.21. Access commercial, government, and education resources
5.2.22. Bookmark web addresses (URLs)
5.2.23. Download files from FTP archives
5.2.24. Communicate via e-mail using the Internet
5.2.25. Subscribe to mailing lists

5.2.26. Retrieve online tools

Teaching methods and contact hours:
Lectures 1 hour/Wk
Computer skills & demonstrations 4 hour/Wk

Assessment
Continuous Assessment 100%

Prescribed text book
William, K (1989). Study Skills. Macmillan Education Ltd., London.

Recommended text books

1. Marshall, L.A and Rowland, F (1989). A guide to learning independently. Open University Press, Milton Heynes.
2. Stallings, W. (1995) Operating Systems 2nd Edition, Prentice Hall,
3. Silberschatz, A. (1994) Operating System Concepts 3rd Edition, Galvin, P.Addison Wesley,
4. Catapult, Inc. Microsoft Word Step by Step Microsoft Press, 1997
5. Catapult, Inc. Microsoft Excel Step by Step Microsoft Press, 1997
6. Catapult, Inc. Microsoft Access Step by Step Microsoft Press, 1997

MODULES IN THE FIRST YEAR

SEMESTER TWO

Programme Name	YEAR	Semester #	Module Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**I**	**II**	**Anatomy & Physiology II**	**AAP 1-2**	1.0

AIM:

1.0 To equip students with the knowledge of he he topographical anatomy, development and histology of organ systems of the body.

2.0 To equip the students with the knowledge of the physiology of organs and organ systems of the body in health.

Objectives

1. Describe the gross appearance, development and histological features of organ systems.
2. Evaluate the gross appearance of organs
3. Evaluate stained sections of normal organs.
4. Describe the layout and function of each component of organs of the body

CONTENT

1.0 Integumentary System
- 1.1 Structure of the skin
- 1.2 Structure of the hair
- 1.3 Glands of the skin

2.0 CARDIOVASCULAR SYSTEM

2.1 Structure of the Heart
- 2.1.1 Describe the structure and innervation of the heart
- 2.1.2 Explain the electrocardiogram and the cardiac cycle

2.2 Conducting System of the Heart
- 2.2.1 Illustrate how the various control mechanisms regulate the cardio-vascular system
- 2.2.2 Explain the physics of blood flow (pressure, resistance, velocity)

2.3 Cardiac Cycle and Output
- 2.3.1 Define the cardiac output and blood flow

2.4 Blood Vessels

2.4.1 Describe the types and functions of blood vessels

2.5 Blood Reservoirs

2.5.1 Identify and describe the blood reservoirs

2.6 Physiology of Circulation

2.6.1 Describe the physiology of circulation

2.6.2 Describe the oxygenation and deoxygenation of blood

3.0 RESPIRATORY SYSTEM

3.1 Upper and Lower Respiratory Tract

3.1.1 Describe the structure of the respiratory tract

3.1.2 Describe the mechanisms of lung and pulmonary ventilation

3.2 Respiration

3.2.1 Describe the term respiration

3.2.2 Explain blood gas transport

3.3 Control of Respiration

3.3.1 Identify the various control mechanisms of respiration

4.0 DIGESTIVE SYSTEM

4.1 Oesophagus and Stomach

4.1.1 Describe the structure of the gastrointestinal tract and accessory organs

4.1.2 Describe the process of digestion

4.2 Small and Large Intestine

4.2.1 Describe the process of absorption

4.2.2 Describe the common pathophysiological conditions associated with the gastrointestinal tract

4.3 Applied Physiology

5.0 LYMPHATIC SYSTEM

5.1 lymphatic Vessels

5.1.1 Differentiate lymphatic vessels from blood vessels

5.1.2 Explain the functions of lymphatic vessels

5.2 Lymphatic Tissues

5.2.1 Discuss the characteristics of lymphatic system and tissues

5.3 Lymphatic Circulation

5.3.1 Describe the lymphatic circulation

6.0 URINARY SYSTEM

6.1 The Kidney and Gall Bladder

6.1.1 Describe the structure of the kidney
6.1.2 Explain the process of urine formation
6.1.3 Explain the role of the kidney in acid base balance

6.2 Nephron

6.2.1 Describe the structure of the nephron
6.2.2 Explain the filtration process in the nephron

7.0 REPRODUCTIVE SYSTEM

7.1 The Female Reproductive System

7.1.1 Describe the structure of the uterus and its accessory organs
7.1.2 Explain the female reproductive function
7.1.3 Explain the physiology of menstruation

7.2 Male Reproductive System

7.2.1 Describe the structure of the male reproductive system
7.2.2 Explain the main reproductive function

8.0 ENDOCRINE SYSTEM

8.1 Pituitary Gland

8.1.1 describe the functional divisions of the pituitary gland and their secretions

8.2 Pineal Gland

8.2.1 Describe the functions of the hormones of the pineal gland

8.3 Parathyroid

8.3.1 Explain the principal action and control of the parathyroid hormones

8.4 Thyroid

8.4.1 Explain the synthesis, storage, release and function of thyroid hormones

8.5 Pancreas

8.5.1 Describe the functional divisions of the pancreas and the hormones produced

8.6 Adrenals

8.6.1 Explain the divisions of the adrenal gland and their secretions

9.0 NERVOUS SYSTEM

9.1 Organisation of the Nervous System

9.1.1 Describe the divisions of the nervous system

9.2 Histology of the Nervous System

9.2.1 Classify the cells of the nervous system into nervous and neuralgia

9.3 Physiology of the Nervous System

9.3.1 Describe the transmission of a nerve impulse

9.3.2 Explain the chemicals and/or hormones involved in the transmission of a nerve impulse

9.3.3 Discuss the response to stimuli

9.4 Central Nervous System

9.4.1 Describe the structure and function of the central nervous system

9.5 Autonomic Nervous System

9.5.1 Explain the physiology of the autonomic nervous system

10.0 SPECIAL SENSE ORGANS

10.1 Eye

10.1.1 Describe the structure of the eye

10.1.2 Explain the physiological functions of the eye

10.2 Tongue

10.2.1 Describe the structure of the tongue

10.2.2 Describe the gustatory receptors and the neural pathway for taste

10.3 Nose

10.3.1 Describe the function of the nose

10.4 Ear

10.4.1 Describe the anatomical subdivision of the ear and the principal events in the physiology of hearing

Programme Name	YEAR	Semester #	Module Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**I**	**II**	**Analytical Techniques & Instrumentation**	**ATI 1-2**	

AIM:

To Equip students with the knowledge and skills necessary in the operation maintenance and interpretation of results obtained from various analytical and instrumentation techniques in Biomedical Sciences.

OBJECTIVES:

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

1. Explain underlying principles of analytical techniques used in Biomedical Sciences.
2. Operate the analytical instruments and interpret the data generated.
3. Carry out user maintenance procedures on laboratory equipment.

CONTENTS:

1.0. SPECTROSCOPY

1.1. General principles

1.1.1. Define the concept of spectroscopy

1.1.2. Describe the electromagnetic spectrum (EMS)

1.2. Visible and ultraviolet (UV) light spectrophotometer

1.2.1. State the difference between visible and ultra violet spectrophotometry

1.2.2. Explain the use, advantages and disadvantages of the visible and ultraviolet techniques compared with other analytical techniques

1.2.3. Employ the mathematical expression relating the absorbance of a solution to its concentration (Beer - Lambart's law)

1.2.4. Relate absorbance to percentage transmittance (A = 2 – log % T)

1.2.5. Explain the working principles of a simple colorimeter and a single beam UV / visible spectrophotometer

1.2.6. Use both instruments to measure absorbencies of substances at different wavelengths.

1.2.7. Describe various factors affecting spectrophotometric measurements

1.2.8. Use a double beam spectrophotometer to show the relationship between absorbance and wavelength
1.2.9. Discuss the role of UV / visible spectrophotometry in Biomedical Sciences
1.2.10. Discuss the principle and application of turbidimetry and nephelometry

1.3. Infra-red (IR) spectrophotometer

1.3.1. Describe the basic principles of IR spectrophotometry
1.3.2. State the role of IR spectrophotometric assays in Biomedical Sciences
1.3.3. Compare IR and UV / visible spectrophotometers

1.4. Circular dichroism (CD) spectroscopy

1.4.1. Explain the concept of circular dichroism
1.4.2. Describe the basic principle of circular dichroism
1.4.3. State the role of circular dichroism in diagnosis of disease.

1.5. Luminometry

1.5.1. Explain the basic principle of luminometry
1.5.2. Compare the role and usefulness of luminometry techniques with other analytical techniques in diagnosis of disease

1.6. Atomic spectroscopy (Atomic absorption and flame emission).

1.6.1. Define atomic emission and absorption
1.6.2. Explain the working principles of flame emission photometry
1.6.3. Describe the working parts of a the basic flame photometer
1.6.4. State the limitations of flame photometry
1.6.5. Discuss the role of flame emission photometry in Biomedical Sciences
1.6.6. Explain the working principles of atomic absorption spectrophotometry.
1.6.7. Describe the working parts of single and double beam atomic absorption spectrophotometer
1.6.8. State the factors affecting atomic absorption measurements
1.6.9. Discuss the role of atomic absorption in Biomedical Sciences

2.0. CENTRIFUGATION

2.1 Principle of sedimentation

2.1.1 Define centrifugation, centrifugal force, centripetal force
2.1.2 Describe the basic principles of centrifugation

2.1.3 Describe the various types of centrifugation used in Biomedical Sciences (Swing out, fixed angle, haematocrit, refrigerated)
2.1.4 Describe the basic working parts of a bench centrifuge
2.1.5 Use the centrifuge to separate specimens into sediment and supernatant
2.1.6 Carry out basic user maintenance of centrifuges.

2.2 Density gradient centrifugation
2.2.1 Explain the principles and application of density gradient centrifugation

2.3 Preparative centrifugation
2.3.1 Describe preparative centrifugation

2.4 Analysis of sub-cellular components with the ultracentrifuge
2.4.1 Distinguish between ordinary centrifugation and ultra centrifugation
2.4.2 Carry out separation of sub-cellular components

2.5 Applications of analytical ultracentrifuges
2.5.1 Carry out separation of specimens by ultra centrifugation

2.6 Safety aspects in the use centrifuges
2.6.1 Carry out routine disinfection procedures on the centrifuge
2.6.2 Check all safety precautions as provided for use of each centrifuge type.

3.0. CHROMATOGRAPHY

3.1 General principles
3.1.1 Define chromatography
3.1.2 Explain the general principles of chromatography

3.2 Column chromatography
3.2.1 Explain the application of column chromatography in Biomedical Sciences
3.2.2 Perform sample analysis using column chromatography
3.2.3 Interpret results from column chromatography and report accordingly
3.2.4 State the limitations of the techniques

3.3 Thin Layer chromatography
3.3.1 State the working principle of thin layer chromatography
3.3.2 Explain the application of thin layer chromatography
3.3.3 Identify the limitations of thin layer chromatography

3.4 Paper chromatography

3.4.1 State the working principle of paper chromatography
3.4.2 Explain the application of paper chromatography
3.4.3 Identify the limitations of paper chromatography

3.5 Adsorption chromatography

3.5.1 State the working principle of adsorption chromatography
3.5.2 Explain the application of adsorption chromatography
3.5.3 Identify the limitations of adsorption chromatography

3.6. Partition chromatography

3.6.1. State the working principles of partition chromatography
3.6.2. Explain the application of partition chromatography
3.6.3. Identify the limitations of partitions chromatography

3.7. Gas-liquid chromatography

3.7.1. State the principle of gas liquid chromatography
3.7.2. Explain the application of gas liquid chromatography
3.7.3. Compare the advantages and disadvantages of gas-liquid chromatography and other chromatographic techniques.
3.7.4. State the limitations of gas –liquid chromatography

3.8. Ion-exchange chromatography

3.8.1. Explain the basic principles of ion exchange chromatography
3.8.2. Explain the application of ion exchange chromatography
3.8.3. State the limitations of ion exchange chromatography

3.9. Affinity chromatography

3.9.1. Explain the basic principles of affinity chromatography
3.9.2. State the application of affinity chromatography

3.10. High performance / pressure liquid chromatography (HPLC)

3.10.1. Explain the basics principles of HPLC
3.10.2. Describe the various applications of HPLC in industry and Medical Science practice
3.10.3. Compare the similarities and differences between HPLC and other types of chromatographic methods.
3.10.4. Identify the limitations of HPLC

3.11. Selection of a chromatographic system.

3.11.1. Detail the criteria for selecting a chromatographic system in an area of work.

4.0. ELECTROPHORESIS

4.1 General principles

4.1.1 Define electrophoresis and electroendosmosis
4.1.2 Explain the general principles of electrophoresis

4.2 Factors affecting electrophoresis

4.2.1 State the factors affecting the equality of electrophoretic separations

4.3 Low and high voltage electrophoresis

4.3.1 Distinguish between low and high voltage electrophoresis in terms of the quality of results obtained.

4.4 Gel electrophoresis

4.4.1 Explain the distinctive features of gel electrophoresis

4.4.2 State the diagnostic applications of gel electrophoresis

4.5 Sodium dodecylsulphate polyacrylamide gel electrophoresis (SDS-Page)

4.5.1 Explain the applications of SDS Page in Biomedical Sciences

4.6 Isoelectric focusing (IEF)

4.6.1 Explain the major differences between conventional electrophoresis with IEF

4.6.2 Explain the applications of IEF in Biomedical Sciences

4.7 Isotachophoresis

4.7.1 State the applications of Isotachophoresis

4.8 Detection, recovery and estimation of compounds.

4.8.1 Perform various electrophoretic techniques and interpret their results.

5.0. RADIOCHEMICAL METHODS

5.1 Nature of radiochemistry

5.1.1 Define the atomic number mass, mass number nuclide, isotope radioactivity

5.1.2 Describe the nuclear events involved in radiochemical decay.

5.1.3 Describe the properties of alpha, beta and gamma radiation

5.1.4 Give examples of alpha, beta, and gamma radiation

5.1.5 State the law of radiochemical decay

5.2 Detection and measurement in radiochemistry

5.2.1 Describe the principles of Geiger – Muller counter, crystal scintillation counter and liquid scintillation counter

5.2.2 Describe the principles of pulse height analyser, coincidence circuitry and anti-coincidence circuitry

5.3 Applications of radioisotopes in Biomedical Sciences

5.3.1 State the general applications of radioisotopes in Biomedical Science practice.

5.4 Handling and disposal of radioactive materials.

5.4.1 Explain the disposal procedures of radioactive materials

6.0. IMMUNOCHEMICAL METHODS

6.1 General principles

6.1.1 Explain the general principles involved in immuno-chemical methods

6.2 Precipitation reactions in free solution

6.2.1 State the nature of precipitation reactions

6.2.2 Carry out various precipitation reactions

6.3 Immuno-diffusion

6.3.1 State the principle of immuno-diffusion

6.3.2 Carry out immuno-diffusion analysis of specimens

6.4 Radioimmunoassay (RIA)

6.4.1 State the principle of RIA and immunoradiometric assays (IRMA)

6.4.2 State the application of the two procedures in hormone assays.

6.5 Enzyme-Linked Immuno-Sorbent Assay (ELISA)

6.5.1 State the principle of ELISA

6.5.2 Identify the various applications of ELISA

6.5.3 Perform ELISA techniques of various specimens

6.6 Fluorescence immunoassays

6.6.1 Explain the principle of fluorescence immunoassay

6.6.2 State the applications of fluorescence immunoassays

6.6.3 Identify factors affecting fluorescence immunoassay techniques.

6.7 Particle counting immunoassays

6.7.1 Review methods of particle assay immunoassays

7.0. ELECTROCHEMICAL METHODS

7.1 Principles of electrochemical techniques

7.1.1 State the basic principles of electrochemical assays

7.2 Measurement of pH by gas electrodes

7.2.1 Define pH in terms of hydrogen ion concentration

7.2.2 Carry out measurements of pH using suitable pH meter

7.3 Ion-selective electrodes (ISE) and gas sensors

7.3.1 State the working principle of ISE and gas sensors

7.3.2 Compare ISE / gas sensor and pH meters

7.4 Oxygen-reduction potentials

7.4.1 Identify the methods of oxygen reduced potential measurements

INSTRUMENTATION

8.0. GLASS AND GLASSWARE

8.1 Properties of glass

8.1.1 Define glass

8.1.2 Identify the composition and properties of glass

8.2 Types of glass pipettes and burettes

8.2.1 Specify the various types of pipettes and burettes

8.2.2 Relate the types to their laboratory use and limitations

8.3 Measuring cylinders

8.3.1 State the general use of cylinders

8.3.2 Identify types of cylinders

8.4 Beakers and flasks

8.4.1 State the various types of beakers

8.4.2 Give the main uses of beakers

8.5 Test-tubes and bottles

8.5.1 Give the range of types of test tubes

8.5.2 State the main use of test tubes

8.5.3 Identify the various types of laboratory bottles

8.5.4 State the uses of special laboratory bottles

9.0. LABORATORY EQUIPMENT

9.1. Microscopes

9.1.1 State the basic principle of microscopy

9.1.2 List the various types of microscopy

9.1.3 Give detailed description and application of:

a) Light microscope
b) Dark ground microscope
c) Fluorescence microscope
d) Phase contrast microscope

9.1.4 Carry out general maintenance of microscopes

9.1.5 Give working principle of electron microscopy

9.2 Centrifuges

9.2.1 Carry out basic maintenance of the centrifuge

9.3 Water baths

9.3.1 State the use of water baths
9.3.2 Maintain water baths after routine use

9.4 pH meter
9.4.1 Identify the sensitive features of pH meters
9.4.2 Carry out user maintenance of pH meters

9.5 Distilling and deionising equipment
9.5.1 Identify various types of distillation and deionising equipment
9.5.2 Carry out user maintenance of water stills and deionisers
9.5.3 Identify faults in the efficient performance of stills and deioniser

9.6 Calorimetric and spectrometric equipment
9.6.1 Clean the light pathways of colorimeters and spectrophotometers
9.6.2 Identify faults of the main working parts of the instruments

9.7 Electrophoretic and chromatographic equipment
9.7.1 Carry out routine maintenance of electrophoretic and chromatographic equipment
9.7.2 Identify and correct user serviceable faults of electrophoretic and chromatographic equipment

9.8 Vacuum and pressure pumps
9.8.1 Identify vacuum and pressure pumps
9.8.2 Use the pumps correctly

9.9 Balances
9.9.1 Identify the common laboratory balances
9.9.2 Use the various balances
9.9.3 Maintenance balances

9.10 Refrigerators and other cooling devices
9.10.1 State the major differences between laboratory refrigerators and ordinary domestic refrigerators
9.10.2 Explain the uses of cold rooms in the laboratory
9.10.3 Explain the correct maintenance of refrigerators, freezers and cold rooms

9.11 Tissue processors
9.11.1 Explain the working mechanism of tissues processor
9.11.2 Carry out a full programming of an automatic tissue processors
9.11.3 Carry out routine maintenance of automatic tissue processors

9.12 Staining machines

9.12.1 Explain the working mechanism of staining machines
9.12.2 Carry out a full programming of a staining machine
9.12.3 Carry out routine maintenance of automatic staining machines

9.13 Cell and particle counters

9.13.1 Identify the various types of cell and particle counters
9.13.2 Explain the working mechanism of cell and particle counters
9.13.3 Use cell and particle counters
9.13.4 Carry out regular user maintenance of cell and particle counters
9.13.5 Identify possible common faults in cell and particle counting machines

9.14. Incubators and hot-air ovens

9.14.1. State the role of incubators and hot air ovens
9.14.2. Identify fault in efficiency of operating of incubators and hot air ovens
9.14.3. Distinguish between incubators and hot air ovens.

9.15. Safety cabinets

9.15.1. Identify the types / classes of safety cabinets
9.15.2. State the major uses of each type of safety cabinet
9.15.3. Identify common faults associated with safety cabinets

9.16. Autoclaves

9.16.1. State the practice of autoclaving
9.16.2. Identify the various types of autoclaves
9.16.3. Carry out routine maintenance of laboratory autoclaves

9.17. Electronic cell counting machines

9.17.1. Use electronic cell counting machines
9.17.2. Maintain electronic cell counting machines

9.18. Continuous flow analysers

9.18.1. Identify the common continuos flow analysers
9.18.2. Use continuous flow analysers
9.18.3. Carry out routine maintenance of continuous flow analysers

9.19. Discrete analysers

9.19.1. Identify the common discreet analysers
9.19.2. Use discreet analysers
9.19.3. Carry out routine maintenance of discreet

analysers

Teaching methods and contact hours:

Lectures	3 hour/Wk
Practical	4 hour/Wk

Assessment:

Continuous Assessment		40 %
• Tests	20%	
• Practical reports		15%
• Assignments	5%	
Examinations (Written only)		60 %

Prescribed textbook

Wilson, K and Walker, J (1995). Principles and Techniques of Practical Biochemistry (4th edition). Cambridge University Press, Cambridge.

Recommended textbooks:

Boyer, R.F (1993). Modern Experimental Biochemistry (2nd Edition). Benjamin/Cummings Publishing, Redwood City.

Plummer, D.T (1987). An Introduction to Biochemistry.

Baker, F.J, Silverstone, R.E. and Pallister. C.J (1998). Introduction to Medical Laboratory Technology (7th Edition). Butterworth-Heinemann, Oxford.

Programme Name	YEAR	Semester #	Course Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**I**	**II**	**Laboratory Safety & Ethics**	**LSE 1-2**	0.5

AIM:
To equip students with knowledge and skills in laboratory safety and professional ethics in routine medical laboratory practice.

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

1.0. Demonstrate awareness of the code of conduct and professional ethics at all times in the practice of biomedical sciences.
2.0. Apply the national guidelines for laboratory safety, as stipulated in the safety manual and followed by various laboratories.
3.0. Uphold a high standard of professional ethics in laboratory practice.

1.0. Health and safety

1.1 House-keeping
- 1.1.1 Identify various attributes of a good laboratory design
- 1.1.2 Discuss the importance of a tidy working environment

1.2 Personal hygiene
- 1.2.1 Observe regulations that promote personnel hygiene in the laboratory
- 1.2.2 Describe the value and contents of a first aid kit
- 1.2.3 Practice first aid for all laboratory accidents

1.3 Protective clothing and devices
- 1.3.1 Describe the various types of protective clothing and devices used in the laboratory
- 1.3.2 Demonstrate the use and maintenance of the various protective clothing and devices

1.4 Laboratory hazards
- 1.4.1 List the various types of laboratory hazards
- 1.4.2 Discuss the sources of the various laboratory hazards
- 1.4.3 Describe management of the various types of laboratory hazards

1.5 Storage, handling and disposal of hazardous materials
- 1.5.1 Explain the various methods of storage and handling of hazardous material in the laboratory

1.5.2 Explain the various disposal methods for hazardous material
1.5.3 Discuss the safety regulations governing the storage, handling and disposal of hazardous materials

2.0 Legal issues, professional ethics and guiding policy

2.1 Professional code of conduct and ethics

2.1.1 Demonstrate professionalism when dealing with patients and peers
2.1.2 Understand the laboratory's ethical responsibilities to clients and the community.

2.2 The Biomedical Society of Zambia (BSZ)

2.2.1 Display knowledge of BSZ's role in representing and regulating the profession
2.2.2 Understand the benefits of membership in BSZ.
2.2.3 Demonstrate awareness of BSZ's activities to promote professionalism among its members and conduct continuous professional development

2.3 Medical and Allied Professions Act (Health Professions Bill)

2.3.1 Describe the medical and allied professions Act as relates to Biomedical Sciences profession

2.4 The National Laboratory Policy

2.4.1 Relate medical laboratory practice to the national laboratory policy

Teaching methods and contact hours:

Lectures	2 hours/Wk
Seminars	1 hour/Wk

Assessment:

Assignments	(60%)
Presentations	(40%).

PRESCRIBED TEXT BOOK

1. Pybus R.M. Safety Management Strategy and Practice Butterworth – Heinemann Oxford.
2. Baker F. J. Silvertone and Pallister C.J. (1998) Introduction to Medical Laboratory Technology.

RECOMMENDED TEXT BOOKS:

Collins C.H. (1988) Laboratory Acquired Infections (2nd Ed.) Butterworth – Heinemann Oxford.

Programme Name	YEAR	Semester #	Module Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**I**	**II**	**General Microbiology I**	**MM 1-2**	1.0

AIM:

To Equip the students with knowledge and skills necessary identification of microorganisms and the safe work practices in the microbiology laboratory

OBJECTIVES:
By the end of the module,the students will be able to:

1. Give an account of developments in the discipline of microbiology
2. Describe microbial structures and functions
3. Explain taxonomy and principles of classification of micro-organisms
4. Apply basic microbiological techniques to identify microorganisms
5. Employ safe procedures in the microbiology laboratory
6. Describe the bacterial genetics
7. Explain the basic mechanisms of microbial pathogenicity.

CONTENT:

1.0 Account of developments in the discipline of microbiology
- 1.1 Historical development of microbiology
- 1.2 Role of a microbiology laboratory in the diagnosis, treatment and control of infectious diseases

2.0 Taxonomy and principles of classification of micro-organisms
2.1 Structure of bacteria
2.2 Bacterial growth and physiology
2.3 Bacterial metabolism
2.3.1 Bacterial growth phase
2.3. 2 factors affecting bacterial growth
2.3.3 Principles of bacterial Taxonomy and classification

3.0 Basic laboratory principles and procedures
3.1 Basic requirements of a microbiology laboratory
3.2 Sterilisation and disinfection
3.3 Specimen collection, transportation and processing

3.0 Diagnostic techniques in microbiology
3.3 Preparation of reagents, stains and media
3.4 Cultivation, isolation and enumeration of bacteria
3.5 microbial identification systems
3.6 Principles of serological and immunological diagnosis
3.7 Quality Assurance

4.0 Bacterial genetics
4.1 Bacterial genome
4.2 structure of the bacterial genome
4.2.1 plasmids
4.3 DNA replication and fidelity of replication
4.4 DNA damage and repair
4.5 Bacterial mutations
4.6 Mechanism of gene transfer
4.7 Principles and application of genetic engineering

5.0 **BACTERIAL PATHOGENESIS & HOST RESISTANCE TO INFECTION**
5.1 Basis of bacterial pathogenicity
5.1.1 normal flora
5.1.2 pathogenicity and virulence properties

5.2 Genetic concepts of pathogenicity

5.2.1 Mechanisms of host response and resistance to infection

LABORATORY WORK
Refer to current national SOPs

No.	TITLE	RECOMMENDED SOP METHOD
1	Reagent preparation	SOP level III
2	stain preparation	SOP level III
3	media preparation	SOP level III

TEACHING METHODS AND CONTACT HOURS:
Lectures 3 hours/Wk
Tutorials 1 hours/Wk
Practical 3 hours/Wk

ASSESSMENT:
Continuous Assessment 40%
- Practical reports 20%
- Tests 15%
- Assignments 5%

Examination 60%

- Written 45%
- Practical 15%

PRESCRIBED TEXT BOOK

1. Greenwood, D., Slack, R.C.B. and Peutherer, J.F. (2007). Medical Microbiology: A guide to Microbial Infections: Pathogenesis, Immunity, Laboratory Diagnosis and Control (5th Edition). Churchill Livingstone, Edinburgh.
2. Collee, J.G., Fraser, A., Marmion, B.P. and Simmons, A. (1996). Practical Microbiology (14th Edition) Churchill-Livingstone, Edinburgh.

3. Godkar B.P. and Godkar D.P.,(2007), *Text book of medical laboratory technology,* (2nd edition),Bhalani publishing house, Mumbai.

RECOMMENDED TEXT BOOKS

Brooks, G. F., Butel, J.S. and Ornston, L.N. (1991). Medical Microbiology. (18th Edition). Appleton & Lange, New Jersey.

McIver, I.M. (1992). Hospital Infection. Edward Arnold, London.

Mims, C.A., Playfair, J.H.L., Roitt, I.M., Wakelin, D.M. and Williams, R. (1993). Medical Microbiology. Mosby, St. Louis.

Murray R. P.,Baron E.J.,Jorgensen J.H.,Pfaller M.A. and Yolken R.H., (2003),*Manual of clinical microbiology*, (8th edition),American Society for microbiology,Washington.Volumes 1and 2

Programme Name	YEAR	Semester #	Course Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**I**	**II**	**Biostatisitics, Epidemiology & Research methods**	**BER 1-2**	1.0

Aims

1.0 To provide students with broad understanding of principal methods of biostatistics and their uses in Biomedical Sciences, .

2.0 To enable students develop understanding of principles of epidemiology and its application in public health.

3.0To enable students develop skills necessary for designing and implementing a research study, analyze and interpret results and write a report.

Objectives
By the end of the course the student should be able to:

1. Demonstrate understanding of principal methods of biostatistics;
2. Apply biostatistical tools in collecting, analysing and interpreting study data;
3. Explain key features and uses of descriptive and analytical epidemiology;
4. Design and implement a research project, analyse results and write a report.

CONTENT

BIOSTATISTICS
1.0 Introduction to Biostatistics

1.1. Definition of Biostatistics
1.2. Tools of Biostatistics
1.3. Role of Biostatistics in Biomedical Sciences

2.0 Biostatistical Data

2.1. Variables and types of biostatistical data
  2.1.1. Discrete
  2.1.2. Continuous
  2.1.3. Qualitative
  2.1.4. Quantitative

2.2. Collection of Data
    2.2.1. Definition of sample
    2.2.2. Types of samples
    2.2.3. Significance of a random sample in research

2.3. Summarisation of biostatistical data
    2.3.1. Pictoral and graphic summarisation
        2.3.1.1. Frequency tables
        2.3.1.2. Cumulative frequency tables
        2.3.1.3. Bar-charts
        2.3.1.4. Histograms
    2.3.2. Numerical summarisation
        2.3.2.1. Measures of location
            i. Mean
            ii. Median
            iii. Mode
        2.3.2.2. Measures of Scatter
            i. Variance
            ii. Standard deviation
            iii. Range
            iv. Mean deviation
            v. Semi inter-quartile range

3.0 Sampling

3.1. Purpose of sampling
3.2. Methods of sampling
    3.2.1. Random sampling
    3.2.2. Systematic sampling
    3.2.3. Stratified sampling
    3.2.4. Quote sampling
    3.2.5. Cluster sampling
    3.2.6. Multistage sampling
3.3. Selection of appropriate sampling method for use
3.4. Advantages and disadvantages of each sampling method
3.5. Randomization
    3.5.1. Purpose of randomization
    3.5.2. Methods of randomization
        3.5.2.1. Permutation
        3.5.2.2. Use of random numbers

4.0 Statistical distributions and their uses

4.1. Probability distribution
    4.1.1. Definition of probability
    4.1.2. Types of probability
    4.1.3. Characteristics of probability distribution
    4.1.4. Product and summation rules of probability
    4.1.5. Uses of probability distribution
        4.1.5.1. Determination of expected number/results

4.1.5.2. Significance testing

4.2. Normal or Gaussian distribution

4.2.1. Characteristics at the Gaussian distribution

4.2.2. Uses of the Gaussian distribution

4.2.2.1. Computation of standard scores

4.2.2.2. Determination of normal probabilities from statistical tables

5.0 Significance testing

5.1. Definition of significance test and its uses

5.2. Procedure for conducting a significance test

5.2.1. Formulation of null (H_0) versus alternative (H_1) hypotheses

5.2.2. Calculation of expected number/results

5.2.3. Selection of level of significance for rational decision-making

6.0 Comparison of two sample means

6.1. Standard normal deviate (*z*) test

6.2. Student's t-test

7.0 Comparison of sample variances

7.1. Chi-squared test

7.1.1. Goodness of fit test

7.1.2. Association tests (ordinary and use of contingency tables)

7.2. The F-test

8.0 Statistical estimation

8.1. Confidence and significance levels

8.2. Degrees of freedom (d.f.)

9.0 Tests of association

9.1. Correlation analysis

9.2. Regression analysis

10.0 Non-parametric statistics

10.1. Definition

10.2. Selected examples

10.2.1. Sign test

10.2.2. Mann Whitney Test

EPIDEMIOLOGY

11.0 Introduction to Epidemiology

11.1. Epidemiology in historical context

11.1.1. Describe the origins of modern epidemiology

11.2. Definitions and scope of epidemiology

11.2.1. Define epidemiology

11.2.2. Explain health and disease

11.2.3. Apply epidemiology to health and disease

11.2.4. Give examples of contributions to epidemiology to various health and environmental situations

11.2.4.1. Explain health and disease
11.2.4.2. Apply epidemiology to health and disease
11.2.4.3. Give examples of contributions of epidemiology to various health and environmental situations

11.3. Uses of epidemiological techniques/information
11.3.1. Discuss uses of epidemiological information
11.3.2. Describe population structure, distribution and size of disease problems in Zambia

12.0 Epidemiology Triad

12.1. Concepts of cause and effect
12.1.1. Explain cause of disease
12.1.2. Describe how disease is established in community
12.1.3. Identify various levels of prevention

12.2. Agent, host and environmental factors
12.2.1. Explain agent, host and environmental factors
12.2.2. Discuss reservoir, mode of transmission and susceptible host
12.2.3. Discuss carrier and different types of carriers

12.3. Chain of infection
12.3.1. Describe the chain of infection

12.4. Screening
12.4.1. Give examples of types of screening and their validity
12.4.2. Discuss the role of screening

13.0 Frequency measures used in epidemiology

13.1. Ratios, proportions and rates
13.1.1. Calculate ratios, proportions and rates
13.1.2. Compare disease rates

13.2. Morbidity frequency measures
13.2.1. Calculate prevalence ratio and rate
13.2.2. Calculate incidence rate

13.3. Mortality frequency measures
13.3.1. Calculate mortality rate, proportionate mortality ratio, standardised mortality ratio

14.0 Epidemiological approach to disease control

14.1. Definition of health and disease
14.1.1. Define health and disease

14.2. Case definition
14.2.1. Define ‘Case’

14.3. Descriptive epidemiology
14.3.1. Discuss the role and limitations of descriptive epidemiology

14.4. Analytical epidemiology
14.4.1. Discuss the role and limitations of analytical epidemiology

RESEARCH METHODOLOGY

15.0 Planning a Research Project

15.1. Practical steps in the planning

15.2. Identifying the research problem
15.3. Statement of the research problem
15.4. Hypothesis testing
15.5. Delimitations of the project
15.6. Importance of the project
15.7. Literature review

16.0 Research Project Format and Management

16.1. Format
16.2. Management of the project
16.3. Financing
16.4. Ethics
16.5. Reporting the findings

TEACHING METHODS AND CONTACT HOURS:

Lectures	Three 1-hour lectures/week
Group assignments	1 hour/week
Practical classes	One 3-hour laboratory session/clinic

ASSESSMENT:

Continuous Assessment	60 %
• Tests	30 %
• Assignments	15 %
• Practical reports	15 %
Examination (Written only)	40 %

Prescibed text books

1. Page, R.M., Cole, G.E. and Timreck, T.C. (1995). Basic Epidemiological Methods and Biostatistics: A Practical Guidebook. Jones & Bartlett, Boston.
2. Crawshaw, J. and J. Chambers. (2001). A Concise Course in Advanced Level Statistics. 4th Edn. Nelson Thomes, Chentemham. ISBN 074875475.

Recommended books

1. Parker, R.E. (1991). Introductory Statistics for Biology. (2nd Edn), Edward Arnold, London.
2. Campbell, M.J. and Machin, D. (1993). Medical Statistics: A Commonsense Approach. 2nd Edn. Wiley and Sons Inc. New York.
3. Baker and Rose. Practical Epidemiology.

Programme Name	YEAR	Semester #	Module Name	Module Code	Module Weight
Diploma-Biomedical Sciences	**I**	**II**	**Biochemistry I**	**BC1-2**	**1.0**

AIM:

To provide students with knowledge of the physico-chemical principles of biochemistry and link these to metabolic processes of the body.

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

1.0. Explain the physiological and pathophysiological changes in the body.
2.0. Describe the nature, function and regulation of enzyme activity
3.0. Describe the structure of Nucleic acids
4.0. Explain the process of Protein synthesis
5.0. Carry out basic biochemistry practicals .

1.0. PHYSIOLOGICAL BUFFERS

1.1. Definition and meaning of pH

1.1.1. Define pH
1.1.2. Explain the concept of pH in terms of hydrogen ions

1.2. Effects of pH on biological processes

1.2.1. Define a buffer
1.2.2. Explain the role of a buffer in a given solution
1.2.3. Explain why maintenance of pH is important for biological processes

1.3. Physiological buffers and acid-base balance

1.3.1. Identify the various buffers of the blood
1.3.2. Explain the basic mechanism of buffering by physiological buffers

2.0. ENZYMES

2.1. Nomenclature and classification

2.1.1. Describe the enzyme commission (EC) system of enzyme nomenclature and classification

2.2. Structure and function

2.2.1. Explain the chemical nature and structure of enzymes
2.2.2. Describe the general functions of enzymes
2.2.3. Describe iso enzymes

2.2.4. Explain the structure and function of coenzymes

2.3. Properties and kinetics

2.3.1. Describe the general properties of enzymes based on their general structure

2.3.2. Explain enzyme kinetics

2.4. Factors affecting enzyme activity

2.4.1. Identify factors affecting activity of enzymes

2.4.2. Describe the mechanism of enzyme inhibitors

2.4.3. Describe allosteric enzymes

2.5. Metabolic control and regulation

2.5.1. Describe the control of enzyme activity

2.5.2. Explain enzyme regulation

3.0. VITAMINS

3.1. Classification and function

3.1.1. Explain the classifications of vitamins

3.1.2. Describe the structure and function of vitamins

3.2. Water-soluble vitamins

3.2.1. Identify the water soluble vitamins

3.2.2. Explain the properties and functions of water soluble vitamins

3.3. Fat-soluble vitamins

3.3.1. Identify the fat soluble vitamins

3.3.2. Explain the properties and functions of fat soluble vitamins

3.3.3. Discuss effects of deficiencies of these vitamins

4.0. Nucleic acids and urates

4.1. Synthesis of purine and pyrimidine neucleotides

4.1.1. Explain purines and pyrimidines as bases for nucleic acid synthesis

4.1.2. Outline the structure of nucleosides and neucleotides

4.1.3. Describe the basic properties of nucleotides

4.1.4. Discuss the synthesis of purine nucleotides

4.1.5. Discuss the synthesis of pyrimidine nucleotides

4.2. Fate of purines

4.2.1. Discuss the degradation of purines in humans

4.3. DNA properties

4.3.1. Explain the basic structure of deoxyribonucleic acid (DNA)

4.3.2. Describe the role of DNA

4.4. RNA properties

4.4.1. Explain the basic structure of ribonucleic acid (RNA)

4.4.2. Describe the role of ribonucleic acid

4.5. Urate metabolism

4.5.1. Describe the biosynthesis of urates

4.5.2. Explain the significance of urates

5.0. PROTEIN SYNTHESIS

5.1. DNA structure

5.1.1. Explain the biosynthesis of DNA

5.2. Transcription

5.2.1. Explain the mechanism of transcription

5.3. Translation

5.3.1. Explain the mechanism of translation

5.4. Post-translational events

5.4.1. Detail post- translational events

LABORATORY WORK:
Refer to current national SOPs

No.	TITLE	RECOMMENDED SOP METHOD
1	Preparation of buffers	Enzyme specific methods
2	Enzyme assay	
3	Vitamin assay	
4	Total protein determination and protein separation	Biuret Electrophoresis

Teaching methods and contact hours:

Lectures 3 hour/Wk
Tutorials 1 hour/Wk
Practical classes 2 hour/Wk

Assessment:

Continuous Assessment 40%
- Tests, 15 %
- Assignments 15 %
- Practical Reports 10 %

Examinations 60%
(Written only)

Prescribed text book

Stryer, L (1995). Biochemistry. (4th Edn). W.H. Freeman, New York.

Recommended books:

Zubay, G.L., Parsons, W.W. and Vance (1995), D.E. Principles of Biochemistry. W. C. Brown, Dubuque.

Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1997). Principles of Biochemistry (2nd Edn) Worth Publishers, New York.

MODULES IN THE SECOND YEAR

SEMESTER TWO

Programme Name	YEAR	Semester #	Module Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**II**	**I**	**Biochemistry II**	**BC 2-1**	1.0

AIM:

To provide the student with the knowledge and skills necessary to investigate the biochemical changes in health and disease.

OBJECTIVES:
By the end of the module the student should be able to:

- Explain energy generation and utilisation in metabolic processes.
- Describe various metabolic pathways
- Carry out basic biochemistry practicals.

CONTENT:

1.0. BIOENERGETICS

1.1. Concepts of free energy

1.1.1. Explain the concept of free energy
1.1.2. Explain how ATP is produced and utilised.

1.2. Thermodynamic relationships and energy rich compounds

1.2.1. Define first and second law of thermodynamics
1.2.2. Discuss the usefulness of free energy change (ΔG) in biochemistry
1.2.3. Classify compounds on the basis of energy released on hydrolysis of specific groups

1.3. Energy producing and energy utilizing systems

1.3.1. Discuss the various energy producing and energy utilizing systems
1.3.2. Discuss the determination of free energy changes
1.3.3. Explain the transfer of high energy bond energies of various groups from one compound to another

1.4. The tricaboxylic acid cycle (TCA) and the general inter-relationships of metabolic pathways

1.4.1. State the value of TCA
1.4.2. Discuss the TCA cycle
1.4.3. Outline the major energy yielding steps in TCA
1.4.4. Explain the role of all metabolic pathways

1.5. Energy capture and coupled reactions

1.5.1. Explain the process of energy capture in coupled reactions

2.0. CARBOHYDRATE METABOLISM

2.1. Glycolysis

2.1.1. Discuss the role of glycolysis in different cells
2.1.2. Explain the energy yield in glycolysis
2.1.3. Identify the three major stages of glycolysis including details of the reactions

2.2. Regulation of glycolysis

2.2.1. Describe the regulation of the glycolytic pathway
2.2.2. Give the major differences between hexo-kinase and glucokinase
2.2.3. Explain the role of 6 phospho-fructo - 1- kinase
2.2.4. State the role of pyruvate kinase in the regulation of glycolysis

2.3. Gluconeogenesis

2.3.1. Define gluconeogenesis
2.3.2. Explain the importance of glucose synthesis from non carbohydrate substances
2.3.3. Outline the role of cori cycle and alanine cycle in gluconeogenesis
2.3.4. Explain the biosynthesis of glucose from amino acids, fats and other sugars
2.3.5. Explain in brief the sites of regulation of gluconeogenesis

2.4. Pentose phosphate pathway

2.4.1. Outline the pathway
2.4.2. Identify the two major phases of the pathway

2.5. Sugar inter-conversions and nucleotide sugar formation

2.5.1. Explain in brief how sugars may be inter converted
2.5.2. Explain the role of NADPH

2.6. Biosynthesis of complex carbohydrates

2.6.1. Give an outline of the biosynthesis of complex carbohydrates

2.7. Clinical correlation of carbohydrate metabolism dysfunction

2.7.1. Explain the cause and detection of fructosuria

2.7.2. Explain the cause and detection of fructose intolerance
2.7.3. Explain the cause and detection of galactosaemia
2.7.4. Explain the cause and detection of pentosuria

3.0. LIPID METABOLISM

3.1. Utilization of fatty acids for energy production (Beta oxidation)

3.1.1. Reveal the absorption of fatty acids from the diet
3.1.2. Discuss the beta oxidation of saturated fatty acids in detail
3.1.3. Calculate the energy yield from beta oxidation of fatty acids
3.1.4. Compare beta oxidation with palmitate biosynthesis
3.1.5. Discuss the modification of beta oxidation for the metabolism of some fatty acids especially those with odd numbers of carbon atoms

3.2. Lipids biosynthesis (Phospholipids Cholesterol Sphingolipid Prostaglandins and thromboxanes, glycoproteins)

3.2.1. Examine the structural arrangements of glycerophospholipids, phosphatidylcholine and phosphotidylserine
3.2.2. Explain the functions of phospholipids
3.2.3. Explain the biosynthesis of cholesterol
3.2.4. Describe the biosynthesis and role of sphingolipids
3.2.5. Describe the biosynthesis and role of prostaglandins
3.2.6. Describe the biosynthesis and role of thromboxanes
3.2.7. Describe the biosynthesis and role of glycoproteins

3.3. Clinical correlation of lipid metabolism dysfunction

3.3.1. Discuss ketonemia and diabetic ketoacidosis
3.3.2. Discuss the genetic abnormalities in lipid energy transport
3.3.3. Discuss steatorrhea

4.0. PROTEIN METABOLISM

4.1. Transamination and deamination

4.1.1. Describe the basic structures and characteristics of amino acids
4.1.2. Explain the importance of transamination of amino acids
4.1.3. Explain the importance of deamination of amino acids

4.2. Urea cycle (and other non protein nitrogenous compounds)

4.2.1. State the main role of the urea cycle
4.2.2. Outline the urea cycle
4.2.3. Trace the source and value of phosphate in the urea cycle
4.2.4. Discuss the metabolic disorders of the urea cycle

4.2.5. Discuss the nitrogen balance in the human body
4.2.6. Discuss the pyridoxal-5-phosphate as a co-factor for amino transaminases
4.2.7. Illustrate the process of protein degradation

4.3. Regulation of the urea cycle
4.3.1. Discuss the regulation of the urea cycle

4.4. Clinical correlation of protein metabolism dysfunction
4.4.1. Discuss folic acid deficiency
4.4.2. Discuss phenylketonuria
4.4.3. Discuss disorders of tyrosine metabolism
4.4.4. Discuss Parkinson's disease

5.0. WATER AND ELECTROLYTE METABOLISM

5.1. Water balance
5.1.1. Review the chemical nature and properties of water
5.1.2. Explain the functions of water in the maintenance of steady state of the body
5.1.3. Describe conditions of dehydration and over hydration
5.1.4. Explain the role of hormones in the maintenance of water balance

5.2. Electrolyte balance
5.2.1. Identify the principal elements and trace metals in the human body
5.2.2. State the role of principal elements and trace metals in the body
5.2.3. Explain the pathological conditions associated with abnormal levels of principal and trace metals in the body.

LABORATORY WORK
Refer to current national SOPs

No	TITLE	RECPOMMENDED SOP METHOD
1	Determination of electrolyte levels in body fluids:	
	• Sodium / Potassium • Chlorides • Calcium • Phosphates • Iron	• Flame emission photometry Titration (Shades and Schales) • O- cresolphthalein • Phosphomolybdate • Kit – Boehringer using chromogens
2	Separation and assay of lipoproteins and cholesterol Watson	Method (3-hydroxy -5- /sulphuric acid reaction - cholesterol

Teaching methods and contact hours:

Lectures	3 hour/Wk
Tutorials	1 hour/Wk
Practical	3 hour/Wk

Assessment:

Continuous Assessment		40%
• Practical reports	20%	
• Tests	15%	
• Assignments	5%	
Examination		60%
• Written	45%	
• Practical	15%	

Prescribed text books

1. Stryer, L (1995). Biochemistry. (4th Edn). W.H. Freeman, New York.
2. Devlin, T.M. (1992). (editor) Textbook of Biochemistry with Clinical Correlations. (3rd Edition). Wiley- Liss, New York.
3. Varley, H., Gowenlock, A.H. and Bell, M. (1984). Practical Clinical Biochemistry. (5th Edition). Volume 1; General Topics and Commoner Tests. William Heinemann Medical Books, London

Recommended text books

Zilva, J.F., Pannal, R.P. and Mayne, P.D.. (1998). Clinical Chemistry in Diagnosis and Treatment. (5th Edition). Lloyd-Luke Medical Books, London.

Programme Name	YEAR	Semester #	Module Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**II**	**I**	**Haematology I**	**HM 2-2**	1.0

AIM:

To provide students with essential knowledge and skills necesary for high quality performance in Haematology.

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

1.0. Trace the origin, development, structure and physiology of blood cells
2.0. Recognise blood cell types and perform haematological techniques
3.0. Describe disorders of blood and blood cells, including their pathogenesis ,aetiology, epidemiology, pathology and lab diagnosis
4.0. Explain principles of automated blood cell analysers.
5.0. Observe and practice quality assurance procedures.

CONTENT:

1.0. 1.0 Introduction to Haematology
1.1 Nature and scope of Haematology
1.2 Role of Haematology in health-care

2.0 Collection and handling of blood. (Phlebotomy)
2.4.1 Explain the methods used in blood collection
2.4.2 Describe the various anticoagulants used in haematology
2.4.3 Describe the effect of anticoagulants on storage of blood

3.0 Hazards of handling blood.
3.1Show the hazards associated with handling of blood
3.2 Explain the safety precautions used to prevent such hazards

4.0 Haemopoeisis

4.1 Blood formation in the embryo
4.1.1Describe the models of developmental haemopoiesis
4.1.2Describe haemopoietic growth regulations

Bone marrow structure and function
Describe the models of medullary haemopoiesis
Describe the bone marrow structure and function
Differentiate cells of the bone marrow

Erythropoiesis
Describe the process of erythropoiesis
Differentiate erythroid cells
Recognise erythroid cells

Leukopoiesis
Describe the process of leucopoiesis
Differentiate myeloid cells
Recognise myeloid cells
Recognise lymphoid cells

Thrombopoiesis
Describe the process of thrombopoiesis
Recognise thrombocytes

Bone marrow preparation and examination
Describe the techniques used in collection
Describe the techniques used in processing and staining of bone marrow

5. Blood cell structure and physiology
Red cell structure and functions
Describe the structure of red cell membrane
Describe the function of red cell membrane

Haemoglobin (Hb) synthesis, structure and function
Describe the synthesis of haemoglobin
Describe the structure of the haemoglobin molecule
Describe the function of the haemoglobin molecule
Red cell metabolic pathway
Describe the Embden Meyerhoff pathway
Describe the Pentose Phosphate pathway

Leucocyte physiology and functions
Describe the structure of leucocytes
Describe the function of leucocytes
Perform leucocyte count

Platelet structure and function
Describe the structure of platelets
Describe the function of platelets
Perform platelet count

6. Haematological techniques

Counting chambers and techniques

Describe various types of counting chambers
Use various types of counting chambers
Perform various counting techniques

Haemoglobin estimation

Describe various methods of haemoglobin estimation
Employ various haemoglobin estimation methods

Packed cell Volume (Haematocrit)

Describe the technique of packed cell volume
Carry out packed cell volume method
Calculate red cell indices

7. Automation

Impedance counters

Explain the principle of electrical impedance counters
Apply the principle of impedance counters
Identify and correct errors associated with impedance counters

Light Scattering counters

Explain the principle of light scattering counters
Apply he principle of light scattering counters
Identify and correct errors associated with light scattering counters

8. PRINCIPLES OF QUALITY ASSURANCE

External quality assessment

Define external quality assessment
Carry out procedures of external quality control
Interpret external quality assurance charts

Internal quality control

Define internal quality control assessment
Employ procedures of internal quality control
Interpret internal quality assurance charts

LABORATORY WORK

Refer to current national SOPs

No.	TITLE	RECOMMENDED SOP METHOD
1	Leucocyte count	Total white cell count manual method (Neubauer counting chamber)
2	Platelet count	Platelet count manual method (neubauer counting chamber)
3	Haemoglobin estimation	Cyanmethaemoglobin method
4	Haematocrit method	Centrifugation method – Micro haematocrit

		centrifuge
5	RBC count and calculation of indicies(MCH,MCHC,MCV,RDW,)	
6	Film preparation and staining including bone marrow	May Grunwald – Giemsa stain

TEACHING METHODS AND CONTACT HOURS:

Lectures 3 hours/Wk
Tutorials 1 hour/Wk
Practicals 3 hour/Wk

ASSESSMENT:

Continuous Assessment 40%

- Tests 10 %
- Assignments 15 %
- Practical Reports 15 %

Examinations 60%
(Written only)

PRESCIBED TEXT BOOK

Dacie, J.V. and Lewis, S.M. (1994). Practical Haematology (6th Edn). Churchill-Livingstone, Edinburgh.

RECOMMENDED BOOKS:

Pallister, C.J. (1999). Biomedical Sciences Explained: Haematology. Butterworth-Heinemann, Oxford.
Pallister, C.J. (1994). Blood Physiology and Pathophysiology. Butterworth-Heinemann, Oxford.

Programme Name	YEAR	Semester #	Course Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**II**	**I**	**Immunology**	**IM 2-1**	1.0

AIM:

To Provide students with fundamental knowledge of immunity, immune system, immune responses and the techniques used in immunology

OBJECTIVES:

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

1. Describe the components and functions of the immune system and immune responses
2. Integrate the immunological knowledge of clinical syndromes.
3. Organise and Interpret immunological data and correlate with clinical findings
4. Apply immunological techniques to diagnosis, therapeutics and research

1.0 Introduction to Immunology

1.1 Impact of infectious disease
1.2 Immune system
1.3 Immune response

2.0 Innate Immunity

2.1 Acute inflammatory reaction
2.1.1 Describe inflammation and inflammatory reaction
2.1.2 Discuss the cells and molecules involved in inflammation

2.2 Leukocytes
2.2.1 Describe the lymphoid system
2.2.2 Describe the generation of leucocytes from stem cells
2.2.3 Describe the different types of leucocytes and their function

2.3 Complement system
2.3.1 Define the complement system
2.3.2 Describe the classical and alternate pathway of the complement system

2.2.3 Describe the role of the different complement components and the role of the complement system in immunity

2.3 Non immunological defence mechanism

2.4.1 Discuss the various non immunological defence mechanisms of the body

3. **Cells of adaptive immunity**

3.1 B-cells and their functions

3.1.1Describe the generation of different B lymphocytes and their function

3.2 T- cells and their functions

3.2.1Describe the generation of T lymphocytes

3.2.1Describe the different types of T lymphocyte and their function

4. **Molecules and processes of adaptive immunty**

Immunoglobulin supergene family (The antibody molecule)

4.1.1Describe the structure and function of an antibody molecule

4.1.2.Describe the immunoglobulin super gene family

4.2 General features of antigens

4.2.1Describe an antigen and give examples of different types of antigens

4.3 B-cell and T-cell epitopes

4.3.1Discuss the recognition of different forms of antigen by B and T cells

4.4 Antigen processing and presentation

4.4.1 Antigen processing

4.4.2 Antigen presentation to T Cells

4.5 Antibody diversity

4.5.1Discuss the 5 major classes of immunoglobulins

4.5.2 Discuss how antibody diversity is achieved

4.6 Antigen-antibody interactions

4.6.1 Discuss the different types of antigen- antibody interactions

4.6.2 Discuss affinity and specificity in relation to antibody antigen reaction

4.7 Major Histocompatibility complex (MHC) molecules

4.7.1Define Major Histocompatibility Complex
4.7.1 Describe and discuss the various MHC molecules

4.8 T-cell receptor (TCR)
4.8.1Describe the TCR
4.8.1 Explain the functions of TCR

4.9 Pattern recognition Receptors
4.9.1 Toll-Like receptors (TLRs)
4.9.2 Other MBP, Lectins etc

5.0 IMMUNITY TO INFECTION

5.1 Interaction between innate and adaptive immunity
5.1.1 Describe interactions between innate and adaptive immunity

Escape strategies
2.1.1 Describe how different antigens (micro-organism) evade or escape killing mechanisms of the body

Prophylaxis
Define and describe the phenomenon of Prophylaxis

6. Immunoregulation, Tolerance and Transplantation
Regulatory mechanisms
Mechanisms of tolerance induction and maintenance
Compatibility antigens
Mechanisms and Prevention of graft rejection

7. Disorders of immunity
Anaphylaxis
Define and describe anaphylaxis
Hypersensitivity reactions
Discuss and describe various types of hypersensitivity reactions

Autoimmune diseases
Describe the various autoimmune diseases
Describe the pathogenesis of various autoimmune diseases
Describe the diagnostic methods and treatment

Immunodeficiency
Define primary and secondary immunodeficiency
Discuss deficiencies of innate mechanisms as well as that of B and T cells

Discuss acquired immunodeficiency syndrome (AIDS)

8.0 Tumour immunology

8.1 Describe the nature of tumour antigens
8.2 Discuss immune responses to tumours
8.3 Discuss therapeutic strategies used in tumour therapy

9.0 Principles and concepts Immunological Methods

9.1 Antibody production
9.2 Precipitation and Agglutination of antigens
9.3 Immunolabelling methods and Flow cytometry
9.4 Immunodifusion techniques
9.5 Rosettes and plaques
9.6 Diagnostic and therapeutic use of antibodies
9.7 Molecular Biological techniques – PCR,

10.0 Upcoming/Novel topical issues in Immunology

9.1 Immunogenetics

LABORATORY WORK

Refer to current national SOPs

	TITLE	**RECOMMENDED SOP METHOD**
1	Antigen antibody reactions (Agglutinations tests)	• Pregnancy testing • Rapid plasma reagin (RPR) • Latex agglutination test for the detection of human antibodies to HIV1 and HIV2 in human serum or plasma • Hepatitis B Virus surface antigen (HbsAg) agglutination test • Treponema pallidum haemagglutination assay (TPHA) for the detection of antibodies to Treponema pallidum syphilis • Rheumatoid factor (RF) agglutination test
2 3	Antigen antibody reactions (Enzyme linked immunosorbent assay) Molecular Techniques	• Indirect enzyme linked immunosorbent assay (ELISA) for the detection of HIV 1/ HIV2 antibodies • ELISA for the detection of Hepatitis B surface antigen (HbsAg) • ELISA for the detection of HIV1 / HIV2 • PCR for Detection of HIV, HBV and HCV

Teaching methods and contact hours:

Lectures 3 hour/Wk

Tutorials 1 hour/Wk
Practicals 3 hour/Wk

Assessment:
Continuous Assessment 40%
- Tests, 10 %
- Assignments 15 %
- Practical Reports 15 %

Examinations 60%
(Written only)

Prescibed text book
Roitt, I. (1999). Essential Immunology. Blackwell Scientific, Oxford.

Recommended books:
Roitt, I., Bostoff, J. and Male, D. (1996). Immunology (4th Edn). Mosby, London.

Name		#		Code	Weight
Diploma-Biomedical Sciences	**II**	**I**	**Pharmacology**	**PHM**	0.5

AIM:

To provide students with the essential information on the action of drugs on the body in health and disease.

OBJECTIVES:
At the end of the module, students should be able to:
1. Describe the general mechanism of drug action.
2. Explain the effects of drugs on different systems of the body
3. Categorise chemotherapeutic agents
4. Describe the effects of action of toxic agents.

CONTENT:

1.0. GENERAL MECHANISMS OF DRUG ACTION

1.1. Definition of pharmacological terms

1.1.1. Definition of pharmacological terms, potency, sensitivity, ECN notion, selectivity and summation

1.1.2. Describe the role of receptors, neurotransmitters, autacoids or hormones

1.2. Drugs and receptors

1.2.1. Describe the concept of drug interaction with receptors

1.3. Pharmacokinetics and pharmacodynamics

1.3.1. Explain the concept of pharmacokinetics

1.3.2. Explain the concept of pharmacodynamics

1.4. Drug bio-transformations and fate

1.4.1. Explain the role and mechanism of biotransformation in drug deposition

2.0. CATEGORIES OF CHEMOTHERAPEUTIC AGENTS.

2.1. Principles of chemotherapy

2.1.1. Explain the basic principles of chemotherapy

2.2. Anti-microbial agents

2.2.1. Describe the mode of action of various anti microbial agents

2.3. Anti-fungal agents

2.3.1. Describe the mode of action of various anti-fungal agents

2.4. Parasitic chemotherapy

2.4.1. Explain strategies employed in the treatment of parasitic diseases

2.5. Anti-viral agents

2.5.1. Describe the mode of action of antiviral agents

2.6. Anti-cancer agents

2.6.1. Describe the mode of action of anti cancer agents

2.7. Cancer chemotherapy

2.7.1. Describe the mode of action of cancer chemotherapy

2.8. Immunotherapy

2.8.1. Explain the treatment of disease at immunological level

3.0. EFFECTS OF NON-THERAPEUTIC DRUGS

3.1. Alcohol

3.1.1. Describe the effects of alcohol on the central nervous system (CNS) and the liver

3.1.2. Nicotine

3.1.3. Describe the effects of nicotine on the CNS and the liver

3.2. Cannabis

3.2.1. Describe the effects of cannabis on the CNS

3.3. Other non-therapeutic drugs

3.3.1. Describe the effects of other non therapeutic drugs on the CNS and the liver

4.0. ACTION OF TOXIC AGENTS

4.1. Classes of toxic compounds

4.1.1. Classify toxic compounds

4.2. Mechanisms affecting toxicity

4.2.1. Explain the basic mechanism affecting toxicity

4.3. Factors affecting toxicity

4.3.1. Identify the various factors affecting toxicity

4.4. Examples of toxic effects

4.4.1. Explain possible adverse effects of drugs on development: embryonic or fetal death; major structure malformation; growth retardation functional defects

4.5. Toxicity testing

4.5.1. Outline various methods of monitoring toxicity levels

5.0. EFFECT OF DRUGS ON VARIOUS SYSTEMS

5.1. Cardiovascular

5.1.1. Describe the physiology of cardiac function

5.1.2. Describe the pathophysiology and treatment of hypertension

5.1.3. Describe the pathophysiology and treatment of ischaemic heart disease

5.1.4. Describe the pathophysiology and treatment of angina

5.1.5. Describe the pathophysiology of cardiac failure

5.2. Central Nervous System

5.2.1. Identify various types of chemical transmitters and explain their effects

5.2.2. Describe the action of general anaesthetics and their effects

5.2.3. Describe the action of local anaesthetics and their effects

5.2.4. Discuss the various mental illnesses and describe their treatment

5.3. Gastro-Intestinal Tract

5.3.1. Describe the pathophysiology of diarrhoea and its treatment

5.3.2. Describe the pathophysiology of constipation and its treatment

5.4. Respiratory Tract

5.4.1. Explain the effects of drugs on the respiratory tract in the treatment of asthma

5.4.2. Explain the management of acute and chronic asthma

5.5. Endocrine system

5.5.1. Explain the action of drugs and hormones on the hypothalamus and pituitary gland

5.5.2. Explain the action of thyroid hormones and anti thyroid drugs

5.5.3. Explain the adreno-corticosteroids and adreno-cortical antagonists

5.5.4. Explain the role of pancreatic hormones and control of diabetes

5.5.5. Explain the pharmacology of selected drugs and hormones acting on the reproductive system

Teaching methods and conact hours:

Lectures	3hour/Wk
Tutorials	1hour/Wk

Practicals and demonstrations 1hour/Wk.

Assessment:

Continuous assessment. 40%

- Tests 15 %
- Assignments 20 %
- Practical reports 5 %

Examination 60%
(Written only)

Prescibed text book

Foster R.W. (1999). Basic Pharmacology. Butterworth – Heinemann, Oxford.

Recommended text books

1. Rang et al. (1995) Pharmacology 3rd ED. Churchill – Livingstone, London.
2. Brody et al.(1994) Human Pharmacology 2nd Edn, Mosby, St. Louis.
3. Neal M.J. (1992) Medical Pharmacology at a glance, 2nd Edn. Blackwell Scientific, Oxford.

Programme Name	YEAR	Semester #	Course Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**II**	**I**	**Medical Microbiology II (Bacteriology)**	**MM 1-2**	1.0

Aims
To provide students with essential knowledge skills and attitudes necessary for carrying out clinically reliable bacteriological investigations

Objectives
At the end of the course the student should be able to:
1. Identify and Characterise bacteria fully
2. Differentiate pathogenic from non pathogenic microorganism
3. Describe the pathogenesis of microorganisms
4. Apply principles of bacteriology to diagnosis and Research

Contents:

1.0 Gram positive Microorganisms
1.1 Gram-positive cocci: *staphylococcus, streptococcus, Enterococcus, Micrococcus, Peptococcus*
1.3Gram-positive bacilli: *Bacillus, Listeria,*

2.0 Gram negative Microorganisms
2.1 Gram-negative cocci: *Neisseria, Moraxella*, Brahamella, Haemophilus *Corynebacteria, Nocardia, Actinomadura, Clostridium*
2.2 Enterobacteriaceae
2.3 Gram-negative bacteria not related to the GIT
Curved Gram negative rods: *Campylobacter, Helicobacter*

3.0 Mycobacteria and other acid-fast organisms

4.0 Non-Gram staining Bacteria: *Mycoplasma, Chlamydia, Rickettsiae*

5.0 Spirochaetes: Borrelia, Treponema, Leptospira

6.0 Anaerobic bacteria

7.0Normal Flora

7.1 Normal Flora of various sites

7.2 Opportunistic infections

8.0 ANTIMICROBIAL AGENTS & SUSCEPTIBILITY TESTING

8.1 Antimicrobial agents and their mechanism of action

8.2 Mechanisms of resistance

8.3 Laboratory control of antimicrobial therapy

8.4 Genetic methods for detecting antimicrobial resistance

Laboartory work

Refer to current national SOPs

No.	TITLE	RECOMMENDED SOP METHOD
1	Reagent preparation	SOP level III
2	stain preparation	SOP level III
3	media preparation	SOP level III
4	Specimen processing • Smear preparation • Staining • Culture • Identification	SOP level III
3	Perform culture susceptibility testing (agar disk diffusion method)	• Stoke method • Comparative method • Kirby Bauer method

Teaching methods and contact hours:

Lectures 3 hours/Wk
Tutorials 1 hours/Wk
Practical 3 hours/Wk

Assessment:

Continuous Assessment 40%
- Practical reports 20%
- Tests 15%
- Assignments 5%

Examination 60%
- Written 45%
- Practical 15%

Prescribed textbooks

1. Greenwood, D., Slack, R.C.B. and Peutherer, J.F. (2007). Medical Microbiology: A guide to Microbial Infections: Pathogenesis, Immunity,

Laboratory Diagnosis and Control (5th Edition). Churchill Livingstone, Edinburgh.

Collee, J.G, Fraser, A.G, Marmion, B.P and Simmons, A (1996). Practical Microbiology (14th Edition). Churchill-Livingstone, Edinburgh.
Godkar B.P. and Godkar D.P.,(2007), *Text book of medical laboratory technology,* (2nd edition),Bhalani publishing house, Mumbai.

Mims, C.A, Playfair, J.H.L, Roitt, I.M, Wakelin, D.M and William, R (1999). Medical Microbiology, Mosby, St. Louis

Recommended references

1. Brooks, G.F, Butel, J.S and Ornston, L.N (1991). Medical Microbiology (18th Edition). Appleton & Lange, New Jersey
2. Mims, C.A. and White, D.O. (1984). Viral pathogenesis and Immunology. Blackwell Scientific Publications, London.
3. Spicer, J (2000). Clinical Bacteriology, Mycology and Parasitology. Churchill-Livingstone, Oxford. ISBN: 0443043655
4. Mims, C.A. (1987). The Pathogenesis of Infectious Disease. (3rd Ed.). Academic Press, New York.
5. Collins, C.H, Lyne, P.M and Grange, J.M (1995). Collins and Lyne's Microbiological Methods (7th Edition). Butterworth-Heinemann, Oxford. ISBN: 0 7506 0653 3
6. Murray R. P.,Baron E.J.,Jorgensen J.H.,Pfaller M.A. and Yolken R.H., (2003),*Manual of clinical microbiology*, (8th edition),American Society for microbiology,Washington.Volumes 1and 2

Programme Name	YEAR	Semester #	Module Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**II**	**I**	**Histology**	**HT 2-1**	1.0

AIM:

To equip the student with the knowledge and skills of histology

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

- Recognise the macroscopic and microscopic appearance of normal and abnormal tissues.
- Carry out various routine and special histological techniques.

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CONTENT

1.0 Review of basic tissues
1.1 Epithelial tissue
1.2 Connective tissue
1.3 Muscle tissue
1.4 Nervous tissue

2.0SKIN
2.1Structure of the skin

3.0 GLANDULAR TISSUE
3.1Types of glandular tissue (exocrine and endocrine)
1.1.1. Differentiate between exocrine and endocrine glandular tissue.

3.2 Modes of secretion
2.5.5 Categorize and define the modes of secretion of merocrine, apocrine and holocrine type of cells of glandular tissue.

3.3 Classification
3.2.1 Describe the structure and function of various exocrine glands

3.4Control of glandular activity
3.4.1 Describe the regulation of glandular activity

4.0 Blood vessels and lymphatic glands/vessels
4.1 Structure and function of arteries, arterioles, capillaries, veins and venules
4.2 Structure of the lymphatics and contrast them with vein

5.0 **Respiratory system**
5.1 Structure, function and composition of the respiratory system
5.2 Different cell types and the olfactory epithelium
5.3 Demonstrate and identify lung tissue

6.0 Gastrointestinal system
6.1 Alimentary canal and its relationship to digestion
6.2 Endocrine cells of the GIT, hormones produced and their major functions
6.3 Lliver structure, the hepatocyte, functions
6.4 Regulations of the liver and a description and function of the gall bladder
6.5 Pancreas and enzyme production
6.6 Cell types of the endocrine portion
6.7 gastro intestinal tract and its accessory organs

7.0 Lymphoid system
7.1 Histological aspects of lymph nodes, tonsils, spleen and thymus
7.2 Structures of lymphoid tissue
7.3 lymphoid tissue

8.0 Urinary system
8.1 Composition of the urinary system with emphasis on the kidney and nephron structure and function
8.2 Cell types, their functions and special features of the system.

9.0 Male and female reproductive system
9.1 Composition, structure and function of the male and female reproductive systems
9.2 Processes of spermatogenesis, meiosis and spermiogenesis of the male reproductive system
9.3 Development and maturation of the follicle
9.4 Epithelia of the female genital tract and the effects of the menstrual cycle on epithelium
9.5 Structure and function of mammary glands

10.0 Endocrine glands
10.1 Structure and functions of the various endocrine glands
10.2 Substances or hormones produced by each gland and the role they play
10.3 Structural functions of endocrine glands

11.0 Sense organs
12.1 Structural divisions and functions of the eye, ear, tongue and nose
12.2 Techniques used in processing and sectioning of the eye
12,3 Description on the retina and its histo-physiology

13.0 Nervous System
13.1 Structure of neuron and neuroglia cells
13.2 Neuropil

Teaching methods and contact hours:

Lectures	3 hours/Wk
Tutorials	1 hour/Wk
Practicals.	3 hours/Wk

Assessments:

Continuous Assessment 40 %

- Tests 20%
- Assignments 10%
- Practical reports 10%

Examination 60 %
(Written only)

Prescribed text books

Bancroft, J.D. and Stevens, A. (1995). Theory & Practice of Histological Techniques. 4th Edition. Churchill-Livingstone, London.

Recommended text books:

1. Stevens, A. and Lowe, J.S. (1992) Human Histology (2nd Edition)
2. Gower Medical, London.
3. Mitchison, M.J., Arno, J., Edwards, P.A.W., LePage, R.W.F. and Minson, A.C. (1996). Essentials of Pathology. Blackwell Scientific, Oxford.
4. Tausig, M. (1991). Processes in Pathology. Blackwell Scientific, Oxford.
5. Dixon, K.C. (1986). Cellular Defects in Disease (2nd Edn). Blackwell Scientific, Oxford.

MODULES IN THE SECOND YEAR

SEMESTER TWO

AIM:

Programme Name	YEAR	Semester #	Course Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**II**	**II**	**Medical Parasitology I**	**Mp 2-2**	1.0

To provide the student with knowledge and practical skills in the study of parasitic infections in humans

OBJECTIVES

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

1. Define terminologies and classify parasites of medical importance
2. Describe the life cycle of parasites, pathogenesis and treatment of parasitic conditions of medical importance
3. Describe the parasitic opportunistic infections related to HIV and AIDS and other conditions
4. Identify the parasitic elements of medical importance in clinical specimens using Standard Operating Procedures (SOPs)
5. Apply preventative and control strategies against parasitic diseases in the community

Contents of the course

1**.0 Introduction to Parasitology**

1.1 Define general terminologies
1.2 Outline the relationship between parasite and animals
1.3 Classify parasites using the international code of zoological nomenclature

2.0 LABORATORY METHODS IN PARASITOLOTY

2.1 Laboratory organization and safety

2.1.1 Describe the organization of a Parasitology laboratory
2.1.2 Discuss safety procedures to avoid laboratory acquired infections

2.2 Collection and preservation of parasites

2.2.1 Describe the various types of specimens for parasitological investigations
2.2.2 Describe the methods used in the collection and preservation of the various specimens and parasites

2.2.3 Prepare the various media for preserving specimens for parasitological investigations

2.3 **Diagnostic methods**

2.3.1 Explain the principles involved in diagnostic methods used in a Parasitology laboratory

2.3.2 Identify the sources of error in diagnostic methods

2.4 **Quality assurance**

2.4.1 Explain the concept of quality assurance in a Parasitology laboratory

2.4.2 Use the principles of quality assurance to compare the various methods used in a Parasitology laboratory

3.0 PROTOZOOLOGY

Describe the geographical distribution, classification, morphology, life cycle, pathogenesis, symptoms, diagnosis and treatment of the following parasites:

3.1 Intestinal Amoebae

3.1.1 *Entamoeba histolytica*

3.1.1.1 Outline the Geographical distribution

3.1.1.2 Classify according to the international zoological rule

3.1.1.3 Describe the morphology

3.1.1.4 Illustrate the life cycle

3.1.1.5 Explain pathological effect on the host

3.1.1.6 Describe laboratory diagnosis

3.1.1.7 Explain control measures and treatment

3.1.2 Opporunistic amoebae: *Entamoeba coli*

3.1.2.1 Outline the Geographical distribution

3.1.2.2 Classify according to the international zoological rule

3.1.2.3 Describe the morphology

3.1.2.4 Illustrate the life cycle

3.1.2.5 Explain pathological effect on the host

3.1.2.6 Describe laboratory diagnosis

3.1.2.7 Explain control measures and treatment

3.1.3 Commensal amoebae: *Entamoeba gingivalis, Entamoeba hartmanii, Endolimax nana*

3.1.3.1 Describe the morphology

3.2 Intestinal and urinogenital flagellates

3.2.1 *Giardia intestinalis*

3.2.1.1 Outline the Geographical distribution

3.2.1.2 Classify according to the international zoological rule

3.2.1.3 Describe the morphology

3.2.1.4 Illustrate the life cycle

3.2.1.5 Explain pathological effect on the host

3.2.1.6 Describe laboratory diagnosis

3.2.1.7 Explain control measures and treatment

3.2.2 Non pathogenic intestinal flagellates: *Trichomonas hominis* and *Chilomastics mesnili*

3.2.2.1 Describe the morphology

3.2.3 *Trichomonas vaginalis*

3.2.3.1 Outline the Geographical distribution
3.2.3.2 Classify according to the international zoological rule
3.2.3.3 Describe the morphology
3.2.3.4 Illustrate the life cycle
3.2.3.5 Explain pathological effect on the host
3.2.3.6 Describe laboratory diagnosis
3.2.3.7 Explain control measures and treatment

3.3 Ciliates

3.3.1 *Balantidium coli*

3.3.1.1 Outline the Geographical distribution
3.3.1.2 Classify according to the international zoological rule
3.3.1.3 Describe the morphology
3.3.1.4 Illustrate the life cycle
3.3.1.5 Explain pathological effect on the host
3.3.1.6 Describe laboratory diagnosis
3.3.1.7 Explain control measures and treatment

3.4 The Apicomplexa

3.4.1 *Plasmodium* Species

3.4.1.1 Outline the Geographical distribution
3.4.1.2 Classify according to the international zoological rule
3.4.1.3 Describe the morphology
3.4.1.4 Illustrate the life cycle
3.4.1.5 Explain pathological effect on the host
3.4.1.6 Describe laboratory diagnosis
3.4.1.7 Describe the role of Histidine Rich Proteins
3.4.1.8 Explain control measures and treatment

3.4.2 *Babesia microti*

3.4.2.1 Outline the Geographical distribution
3.4.2.2 Classify according to the international zoological rule
3.4.2.3 Describe the morphology
3.4.2.4 Illustrate the life cycle
3.4.2.5 Explain pathological effect on the host
3.4.2.6 Describe laboratory diagnosis
3.4.2.7 Explain control measures and treatment

3.4.3 Opportunistic Apicomplexa in HIV and AIDS

3.4.3.1 *Cryptosporidium parvum*

3.4.3.1.1 Outline the Geographical distribution
3.4.3.1.2 Classify according to the international zoological rule
3.4.3.1.3 Describe the morphology
3.4.3.1.4 Illustrate the life cycle
3.4.3.1.5 Explain pathological effect on the host

3.4.3.1.6 Describe laboratory diagnosis
3.4.3.1.7 Explain control measures and treatment

3.4.3.2 *Isospora belli*
3.4.3.2.1 Outline the Geographical distribution
3.4.3.2.2 Classify according to the international zoological rule
3.4.3.2.3 Describe the morphology
3.4.3.2.4 Illustrate the life cycle
3.4.3.2.5 Explain pathological effect on the host
3.4.3.2.6 Describe laboratory diagnosis
3.4.3.2.7 Explain control measures and treatment

3.4.3.3 *Toxoplasma gondii*
3.4.3.3.1 Outline the Geographical distribution
3.4.3.3.2 Classify according to the international zoological rule
3.4.3.3.3 Describe the morphology
3.4.3.3.4 Illustrate the life cycle
3.4.3.3.5 Explain pathological effect on the host
3.4.3.3.6 Describe laboratory diagnosis
3.4.3.3.7 Explain control measures and treatment

3.4.3.4 *Pneumocystis jcoveri*
3.4.3.4.1 Outline the Geographical distribution
3.4.3.4.2 Classify according to the international zoological rule
3.4.3.4.3 Describe the morphology
3.4.3.4.4 Illustrate the life cycle
3.4.3.4.5 Explain pathological effect on the host
3.4.3.4.6 Describe laboratory diagnosis
3.4.3.4.7 Explain control measures and treatment

3.5 Haemoflagellates

3.5.1 *Trypanosoma brucei rhodesiense*
3.5.1.1 Outline the Geographical distribution
3.5.1.2 Classify according to the international zoological rule
3.5.1.3 Describe the morphology
3.5.1.4 Illustrate the life cycle
3.5.1.5 Explain pathological effect on the host
3.5.1.6 Describe laboratory diagnosis
3.5.1.7 Explain control measures and treatment

3.5.2 *Trypanosoma brucei Gambiense*
3.5.2.1 Outline the Geographical distribution
3.5.2.2 Classify according to the international zoological rule
3.5.2.3 Describe the morphology
3.5.2.4 Illustrate the life cycle
3.5.2.5 Explain pathological effect on the host
3.5.2.6 Describe laboratory diagnosis
3.5.2.7 Explain control measures and treatment

3.5.3 *Trypanosoma cruzi*
3.5.3.1 Outline the Geographical distribution
3.5.3.2 Classify according to the international zoological rule
3.5.3.3 Describe the morphology
3.5.3.4 Illustrate the life cycle
3.5.3.5 Explain pathological effect on the host
3.5.3.6 Describe laboratory diagnosis

3.5.3.7 Explain control measures and treatment

3.5.4 *Leishmania tropica*
- 3.5.4.1 Outline the Geographical distribution
- 3.5.4.2 Classify according to the international zoological rule
- 3.5.4.3 Describe the morphology
- 3.5.4.4 Illustrate the life cycle
- 3.5.4.5 Explain pathological effect on the host
- 3.5.4.6 Describe laboratory diagnosis
- 3.5.4.7 Explain control measures and treatment

3.5.5 *Leishmania donovani*
- 3.5.5.1 Outline the Geographical distribution
- 3.5.5.2 Classify according to the international zoological rule
- 3.5.5.3 Describe the morphology
- 3.5.5.4 Illustrate the life cycle
- 3.5.5.5 Explain pathological effect on the host
- 3.5.5.6 Describe laboratory diagnosis
- 3.5.5.7 Explain control measures and treatment

4.0 HELMINTHOLOGY

4.1 Nematodes

4.1.1 *Ascaris lumbricoides*
- 4.1.1.1 Outline the Geographical distribution
- 4.1.1.2 Classify according to the international zoological rule
- 4.1.1.3 Describe the morphology
- 4.1.1.4 Illustrate the life cycle
- 4.1.1.5 Explain pathological effect on the host
- 4.1.1.6 Describe laboratory diagnosis
- 4.1.1.7 Explain control measures and treatment

4.1.2 *Enterobius vermicularis*
- 4.1.2.1 Outline the Geographical distribution
- 4.1.2.2 Classify according to the international zoological rule
- 4.1.2.3 Describe the morphology
- 4.1.2.4 Illustrate the life cycle
- 4.1.2.5 Explain pathological effect on the host
- 4.1.2.6 Describe laboratory diagnosis
- 4.1.2.7 Explain control measures and treatment

4.1.3 *Trichuria trichiura*
- 4.1.3.1 Outline the Geographical distribution
- 4.1.3.2 Classify according to the international zoological rule
- 4.1.3.3 Describe the morphology
- 4.1.3.4 Illustrate the life cycle
- 4.1.3.5 Explain pathological effect on the host
- 4.1.3.6 Describe laboratory diagnosis
- 4.1.3.7 Explain control measures and treatment

4.1.4 *Trichinella spiralis*
- 4.1.4.1 Outline the Geographical distribution
- 4.1.4.2 Classify according to the international zoological rule

4.1.4.3 Describe the morphology
4.1.4.4 Illustrate the life cycle
4.1.4.5 Explain pathological effect on the host
4.1.4.6 Describe laboratory diagnosis
4.1.4.7 Explain control measures and treatment

4.1.5 The thread worm: *Strongyloides stercoralis*
4.1.5.1 Outline the Geographical distribution
4.1.5.2 Classify according to the international zoological rule
4.1.5.3 Describe the morphology
4.1.5.4 Illustrate the life cycle
4.1.5.5 Explain pathological effect on the host
4.1.5.6 Describe laboratory diagnosis
4.1.5.7 Explain control measures and treatment

4.1.6 Hookworms: *Ancylostoma duodenale* and *Necator americanus*
4.1.6.1 Outline the Geographical distribution
4.1.6.2 Classify according to the international zoological rule
4.1.6.3 Describe the morphology
4.1.6.4 Illustrate the life cycle
4.1.6.5 Explain pathological effect on the host
4.1.6.6 Describe laboratory diagnosis
4.1.6.7 Explain control measures and treatment

4.1.7 Vector borne nematodes: *Wuchereria bancrofti*, *Onchocerca volvulus*
4.1.7.1 Outline the Geographical distribution
4.1.7.2 Classify according to the international zoological rule
4.1.7.3 Describe the morphology
4.1.7.4 Illustrate the life cycle
4.1.7.5 Explain pathological effect on the host
4.1.7.6 Describe laboratory diagnosis
4.1.7.7 Explain control measures and treatment

4.2 Trematodes

4.2.1 *Schistosoma mansoni*
4.2.1.1 Outline the Geographical distribution
4.2.1.2 Classify according to the international zoological rule
4.2.1.3 Describe the morphology
4.2.1.4 Illustrate the life cycle
4.2.1.5 Explain pathological effect on the host
4.2.1.6 Describe laboratory diagnosis
4.2.1.7 Explain control measures and treatment

4.2.2 *Schistosoma haematobium*
4.2.2.1 Outline the Geographical distribution
4.2.2.2 Classify according to the international zoological rule
4.2.2.3 Describe the morphology
4.2.2.4 Illustrate the life cycle
4.2.2.5 Explain pathological effect on the host
4.2.2.6 Describe laboratory diagnosis
4.2.2.7 Explain control measures and treatment

4.2.3 *Fasciola hepatica*

4.2.3.1 Outline the Geographical distribution
4.2.3.2 Classify according to the international zoological rule
4.2.3.3 Describe the morphology
4.2.3.4 Illustrate the life cycle
4.2.3.5 Explain pathological effect on the host
4.2.3.6 Describe laboratory diagnosis
4.2.3.7 Explain control measures and treatment

4.2.4 *Clonorcis sinensis*
4.2.4.1 Outline the Geographical distribution
4.2.4.2 Classify according to the international zoological rule
4.2.4.3 Describe the morphology
4.2.4.4 Illustrate the life cycle
4.2.4.5 Explain pathological effect on the host
4.2.4.6 Describe laboratory diagnosis
4.2.4.7 Explain control measures and treatment

4.3 Cestodes

4.3.1 *Taenia saginata*
4.3.1.1 Outline the Geographical distribution
4.3.1.2 Classify according to the international zoological rule
4.3.1.3 Describe the morphology
4.3.1.4 Illustrate the life cycle
4.3.1.5 Explain pathological effect on the host
4.3.1.6 Describe laboratory diagnosis
4.3.1.7 Explain control measures and treatment

4.3.2 *Taenia solium*
4.3.2.1 Outline the Geographical distribution
4.3.2.2 Classify according to the international zoological rule
4.3.2.3 Describe the morphology
4.3.2.4 Illustrate the life cycle
4.3.2.5 Explain pathological effect on the host
4.3.2.6 Describe laboratory diagnosis
4.3.2.7 Explain control measures and treatment

4.3.3 *Echinococcus granulosus*
4.3.3.1 Outline the Geographical distribution
4.3.3.2 Classify according to the international zoological rule
4.3.3.3 Describe the morphology
4.3.3.4 Illustrate the life cycle
4.3.3.5 Explain pathological effect on the host
4.3.3.6 Describe laboratory diagnosis
4.3.3.7 Explain control measures and treatment

4.3.4 *Hymenolepis nana*
4.3.4.1 Outline the Geographical distribution
4.3.4.2 Classify according to the international zoological rule
4.3.4.3 Describe the morphology
4.3.4.4 Illustrate the life cycle
4.3.4.5 Explain pathological effect on the host
4.3.4.6 Describe laboratory diagnosis
4.3.4.7 Explain control measures and treatment

4.3.5 *Diphylobothrium latum*

4.3.5.1 Outline the Geographical distribution
4.3.5.2 Classify according to the international zoological rule
4.3.5.3 Describe the morphology
4.3.5.4 Illustrate the life cycle
4.3.5.5 Explain pathological effect on the host
4.3.5.6 Describe laboratory diagnosis
4.3.5.7 Explain control measures and treatment

4.3.6 *Diphylidium caninum*

4.3.6.1 Outline the Geographical distribution
4.3.6.2 Classify according to the international zoological rule
4.3.6.3 Describe the morphology
4.3.6.4 Illustrate the life cycle
4.3.6.5 Explain pathological effect on the host
4.3.6.6 Describe laboratory diagnosis
4.3.6.7 Explain control measures and treatment

LABORATORY WORK
Refer to SOP

NO.	**TITLE**
1	Macroscopic examination of stool
2	Microscopic examination of stool
3	microscopic examination of stool formal ether
4	Examination of blood for malaria parasites
5	Examination of blood for microfilaria
6	Examination of blood for trypanosomes
7	Examination of urine for parasites
8	Examination of urogenital specimens

Teaching methods and contact hours

- Lectures 3 Hours/Week
- Tutorials 1 Hour/Week
- Laboratory practicals 3 Hours/Week

Assessment Methods

- Continuous assessment 40%

Tests 20%

Laboratory practicals 15%
Assignments
- Examination 60%

Written 40%
Laboratory practical 20%
Viva voce

Prescribed textbooks

1 Markell, E.K, Voge, M and John, D.J (2006). *Medical Parasitology*. W.B. Saunders Company, Philadelphia.
2 Ash R.L.and Orihel C.T.,(1997),*Atlas of Human Parasitology*,4th edition, American society of Clinical pathology press, Chicago.
3 Orihel, T *et al* (1990). *Atlas of Human Parasitology* (3rd Edition). American Society of Clinical Pathology. Raven Press.
4 Despommier, D.D, Gwadz, R.W and Hotez, P.J (1995). *Parasitic Diseases*. Springer-Verlag, Berlin

Recommended references

1. Peters, W and Gilles, H.M (1989). *A colour atlas of Tropical Medicine and Parasitology* (3rd Edition). Wolfe Medical Publications Ltd., Berlin
2. Manson-Bahr, P.E.C. and Bell, D.R (1998). *Manson's Tropical Diseases*. (14th Edition). ELBS, Bailliere-Tindall, London

AIM:

To Provide the student with knowledge and practical skills in the study of parasitic infections in humans

OBJECTIVES

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

6. Define terminologies and classify parasites of medical importance

7. Identify the parasitic elements in clinical specimens using Standard Operating Procedures (SOPs)
8. Describe the life cycles of parasites and mode transmission of parasites
9. Demonstrate knowledge of the pathogenesis and treatment of parasitic conditions
10. Describe preventive and control strategies against parasitic diseases in the community
11. Describe parasitic opportunistic infections related to HIV and AIDS and other conditions.

1.1.1.1.1 <u>Contents of the course</u>

A. **Introduction to Parasitology**
1.0 Common nomenclature
1.1 Classification of parasites

B. PROTOZOOLOGY
2.0 Intestinal Amoebae
2.1 *Entamoeba histolytica*
2.2 Commensal amoebae: *Entamoeba coli, Entamoeba gingivalis, Entamoeba hartmanii, , Endolimax nana*

3.0 Intestinal and urinogenital flagellates
4.1 Giardia intestinalis
4.3 Trichomonas vaginalis
4.3 Non pathogenic intestinal flagellates: *Trichomonas hominis* and *Chilomastics mesnili*

4.0 Ciliates
4.1 *Balantidium coli*
5..0 The Apicomplexa
5.1. **Plasmodium**
- 5.1.1 Morphology, life cycle, Transmission and speciation of Plasmodia
- 5.1.2 Pathogenesis and symptoms; role of Histidine Rich Proteins, symptoms of complicated and uncomplicated malaria.
- 5.1.3. Malaria diagnostic methods:
- 5.1.4. Treatment of Malaria
- 5.1.5 Malaria control strategies
- 5.1.6 Epidemiology

5.2. Opportunistic Apicomplexa in HIV and AIDS
- 5.2.1 Cryptosporidium parvum
- 5.2.2 Isospora belli
- 5.2.3 Toxoplasma gondii

5.2.4 Pneumocystis jcoveri

6.2. Babesia microti

7.0 Haemoflagellates

7.1. African Trypanosomiasis: Trypanosoma brucei rhodesiense, Trypanosoma brucei gambiense,

7.1.1. Morphology lifecycle and, transmission,

7.1.2. Pathogenesis and symptoms, diagnosis, and treatment

7.1.2 Trypanosomiasis and Tsetse control

7.2.American Trypanosomiasis; Trypanosoma cruzi:
Morphology, lifecycle, transmission, pathogenesis,
Symptoms, Diagnosis, and treatment and epidemiology.

7.3. Leishmaniasis: Leishmania tropica, Leishmania donovani
Morphology, lifecycle, transmission, pathogenesis, diagnosis, and treatment and epidemiology

C. HELMINTHOLOGY

1.0 Nematodes

1.1 *Ascaris lumbricoides*
1.2 *Enterobius vermicularis*
1.3 *Trichuria trichiura*
1.4 *Trichinella spiralis*
1.5. The thread worm: *Strongyloides stercoralis*
1.6. Hookworms: *Ancylostoma duodenale* and *Necator americanus*
1.7. Vector borne nematodes: *Wuchereria bancrofti*, *Onchocerca volvulus*

2.0 Trematodes

2.1 *Schistosoma mansoni, S.haematobium*

2.1.1. Morphology, life cycles and transmission

2.1.2 Pathogenesis, symptoms, diagnosis, and treatment

2.1.3. Epidemiology and Control of Schistosomiasis

2.2 Liver flukes: *Fasciola hepatica, Clonorcis sinensis*

3.0 Cestodes

3.1 *Taenia saginata* and *Taenia solium*: Morphology, life cycles and transmission ,Pathogenesis, symptoms, diagnosis, and treatment, Epidemiology and Control
3.2 *Echinococcus granulosus*
3.3 *Hymenolepis nana, Diphylobothrium latum, Diphylidium caninum*

Teaching methods and contact hours

- Lectures 3 Hours/Week

- Tutorials 1 Hour/Week
- Laboratory practicals 3 Hours/Week

Assessment Methods

- Continuous assessment 40%

Tests
Laboratory practicals
Assignments

- Examination 60%

Written
Laboratory practical
Viva voce

Prescribed textbooks

1. Markell, E.K, Voge, M and John, D.J (2006). Medical Parasitology. W.B. Saunders Company, Philadelphia
2. Beaver, P.C *et al* (1984). Clinical Parasitology. Lea and Ferbiger, Philadelphia
   ISBN 0-471-93100
3. Orihel, T *et al* (1990). Atlas of Human Parasitology (3rd Edition). American Society of Clinical Pathology. Raven Press. ISBN 0-89189-305-9
4. Despommier, D.D, Gwadz, R.W and Hotez, P.J (1995). Parasitic Diseases. Springer-Verlag, Berlin

Recommended references

1. Peters, W and Gilles, H.M (1989). A colour atlas of Tropical Medicine and Parasitology (3rd Edition). Wolfe Medical Publications Ltd., Berlin. ISBN 0-7234-1534X
2. Manson-Bahr, P.E.C. and Bell, D.R (1998). Manson's Tropical Diseases. (14th Edition). ELBS, Bailliere-Tindall, London

Spicer, J (2000). Clinical Bacteriology, Mycology and Parasitology.

Programme Name	YEAR	Semester #	Course Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**II**	**II**	**Pathology**	**PT H 2-2**	1.0

AIM;

To provide the students with in-depth knowledge of aietiology mechaninisms and consequences of abnormal changes in the body together with the effects that such changes have on tissues and cells.

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

1. Evaluate the aetiological, pathogenesis and pathophysiology of systemic disease.

2. Recognise the range of pathological change following injury

1. Apply laboratory techniques in diagnosis

Content

1.0 Introduction to Pathology
1.1 Definition of Pathology

2.0 Adaptive tissue alterations
2.1 Aplasia
2.2 Hyperplasia
2.3 Atrophy
2.4 Hypertrophy
2.5 Metaplasia
2.6 Ageing
2.7 Neoplasia

3.0 Causes of injury
3.1 Physical causes
3.2 Chemical causes
3.3 Microbial agents
3.4 Immunological
3.5 Metabolic changes
3.6 Nutritional causes
3.7 Genetics

4.0 Effects of Injury on Cells and Tissues
4.1 Morphologicalchanges
4.2 Biochemical changes

5.0 Host Response to Injury
5.1 Acute inflammation
5.2 Chronic inflammation
5.3 Tissue repair and wound healing

6.0 Neoplasia
6.1 Carcinogenesis
6.2 Oncogenes and cancer
6.3 Proto-oncogenes and tumour-suppressor genes
6.4 Classification and differentiation of tumours
6.5 Invasion and metastasis
6.6 Cancer epidemiology
6.7 Methods of cancer control
6.8 Laboratory diagnosis of neoplasia

7.0 General aspects of systemic diseases
7.1 Cadiovascular system
7.2 Lymphoreticular System
7.3 Respiratory System
7.4 Gastrointestinal System
7.5 Liver, Biliary Tract and Exocrine Pancreas
7.6 Urinary System
7.7 Male Genital System
7.8 Female Genital System and Breast
7.9 Endocrine System
7.10 Skin
7.11 Bones and Joints
7.12 Nervous system

Teaching Methods and Contact Hours
- Lectures 3 hours/week
- Tutorials 1 hour/week
- Laboratory practicals 3 hours/week

Assessment Methods
- Continuous assessment 40%
  Tests
  Laboratory practicals
  Assignments
- Examination 60%
  Written
  Laboratory practical
  Viva voce

Prescribed textbooks

1. Underwood, J.C.E and Hunter, J (2000). General and Systematic Pathology (3rd Edition). Churchill-Livingstone, Edinburgh
2. Chandrasoma, P and Taylor, C.R (1995). Concise Pathology. Lange, Prentice-Hall International, New Jersey
3. Wheater, P.R, Burkitt, H.G, Stevens, A and Lowe, J.S (1995). Basic Histopathology. Churchill-Livingstone, Edinburgh

Recommended references

1. Mitchinson, M.J, Arno, J, Edwards, P.A.W, LePage, R.W.F and Minson, A.C (1996). Essentials of Pathology. Blackwell Scientific Publications, Oxford
2. Spector, T.D and Hall, P (1994). Introduction to General Pathology (4th Edition). Churchill-Livingstone, Edinburgh.
3. Woof, N (2000). Cells, Tissues and Disease (3rd Edition). W.B Saunders, Philadelphia. ISBN: 0702024783
4. Robbins, S.L, Cotran and Kumar, V (1999). Pathologic Basis of Disease. W.B Saunders Company, Philadelphia.
5. Taussig, M (1991). Processes in Pathology. Blackwell Scientific Publications, Oxford
6. McSween, R.M.N and Wharley, K (1996). Muir's Textbook of Pathology. Edward Arnold, London.
7. Curran and Jones (1990). Lecture Notes on Pathology. Blackwell Scientific Publications, Oxford
8. Curran (1992). Colour Atlas of Histopathology. Harvey Millar - Oxford University Press, Oxford.

9.0 Robbins, S.L, Angell, M and Kumar, V (1994). Basic Pathology. W. B Saunders Company, Philadelphia

Programme Name	YEAR	Semester #	Module Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**II**	**II**	**Molecular Biology**	**MB 2-2**	1.0

AIM:
To provide the students with an operational understanding of cellular responses at the molecular level and impart skills necessary for carrying out procedures in recombinant DNA technology.

OBJECTIVES:
At the end of the module, students should be able to:
- Employ the principles and techniques of genetic engineering in the diagnosis of disease.

CONTENT:

1.0. Molecular genetics

1.1. Introduction to Molecular Biology.
1.1.1. Define molecular biology

1.2. Historical perspectives
1.2.1. Discuss the origins of molecular biology i.e. discovery of DNA and RNA

1.3. Current state
1.3.1. Discuss the recent advances in molecular biology

1.4. Future prospects for Biomedical Sciences
1.4.1. Discuss the possible future prospects in relation to treatment, drug design, vaccine design and diagnosis

2.0. Overview of prokaryotic and eukaryotic gene expression

2.1. Bacterial genome and gene expression
2.1.1. Describe the bacterial genome
2.1.2. Describe bacterial gene expression

2.2. DNA replication and fidelity of replication
2.2.1. Describe the process of DNA replication
2.2.2. Discuss the maintenance of high fidelity in DNA replication

2.3. Mutations, mutants and mutagenesis

2.3.1. Define mutation
2.3.2. Describe the different types of mutations
2.3.3. Define and describe the different types of mutants
2.3.4. Discuss the mutagenesis concept

2.4. DNA damage and repair

2.4.1. Describe different mechanisms by which DNA may be damaged
2.4.2. Describe DNA repair mechanisms

2.5. Exchange of genetic information between bacteria

2.5.1. Discuss conjugation, transduction, transformation

2.6. Eukaryotic genome and gene expression

2.6.1. Describe the eukaryotic genome
2.6.2. Describe how the eukaryotic genes are expressed

2.7. Control of gene expression in prokaryotic systems

2.7.1. Discuss the lac and tryp operon

3.0. Genetic engineering

3.1. Concepts of gene cloning

3.1.1. Define gene cloning
3.1.2. Describe cloning vectors, expression vectors
3.1.3. Describe the process of cloning

3.2. Impact on research and biotechnology

3.2.1. Discuss protein production, antibiotic production resulting from cloning and how this has influenced medicine, agriculture and industry in general

4.0. Nucleic acid amplification techniques

4.1. Importance of nucleic acid amplification

4.1.1. Discuss the importance of nucleic acid amplification

4.2. Polymerase Chain Reaction (PCR) and its applications

4.2.1. Define PCR
4.2.2. Explain the elements required for a PCR reaction
4.2.3. Discuss the denaturation, annealing and extension steps of a PCR reaction
4.2.4. Discuss application of PCR to cloning, gene fusion, disease diagnosis in genetic diseases, tissue typing and forensic science

4.3. Other nucleic acid amplification techniques

4.3.1. Describe reverse transcriptase PCR and the other different types of PCR

4.3.2. Explain allele specific amplification and other nucleic acid amplification techniques

4.4. Post amplification detection methods

4.4.1. Discuss the different types of electrophoresis

4.4.2. Describe southern, western and northern blotting

4.4.3. Describe dot (slot) blotting and colony (plaque) blotting

4.4.4. Discuss the various methods of probe labelling

4.4.5. Discuss hybridisation and probe detection

5.0. Basic DNA technology

5.1. Isolation of DNA from cells

5.1.1. Discuss the various methods by which DNA can be isolated from cells

5.2. Restriction enzymes

5.2.1. Discuss the various types of restriction enzymes and the cleavage products

5.3. Cleaving and joining of DNA molecules

5.3.1. Discuss the different methods by which you can cleave DNA and how you can join DNA

6.0. Cloning vectors and their uses

6.1. Plasmids

6.1.1. Describe the basic features of plasmids

6.1.2. Discuss the suitability of plasmids as cloning vectors

6.2. Bacteriophage and cosmid/phagemid vectors

6.2.1. Discuss the basic features of bacteriophage, cosmid / phagemids

6.2.2. Discuss the suitability of the above as cloning vectors

6.3. Yeast artificial chromosomes (YACS)

6.3.1. Describe and define yeast artificial chromosomes

6.3.2. Discuss the structure and use of YAC's

6.3.3. Discuss the application of YAC's

7.0. Introduction of recombinant dna into host cells

7.1. Transformation

7.1.1. Describe the process of transformation

7.2. Selection for transformed cells

14.2.1 Describe the various methods by which you can select cells that have been transformed

Teaching methods and contact hours:

Lectures	3 hour/Wk
Tutorials	1 hour/Wk
Practicals	3 hours/Wk

Assessment:

Continuous assessment 40%

- Tests 20%
- Practical reports 10%
- Assignments 10%

Examinations 60%
(Written only)

Prescribed text book

1. Brown, T.A. (1992). Genetics – A Molecular Approach. Chapman and Hall, London.
2. Brown, T.A. (1995). Gene Cloning – An Introduction. Chapman and Hall, London.

Recommended text books:

1. Alberts, B. et al. (1995). Molecular Biology of the Cell. (3rd Edn) Garland Publishing Inc., New York.
2. Dale, J.W. (1992).Molecular Genetics of Bacteria. John Wiley, New York.

Programme Name	YEAR	Semester #	Course Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**II**	**II**	**Cellular Pathology I**	**PTH 2-2**	1.0

AIM:

To equip the student with the knowledge and skills essential for carrying out histological techniques.

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

1. Evaluate the macroscopic and microscopic appearance of normal and abnormal tissues.
2. Apply various routine and special histochemical techniques for diagnosis of disease.

Content

1.0 PRESERVATION OF SPECIMENS

1.1. Specimen Collection, Reception, Recording and Storage

1.1.1. Discuss and explain the nature and collection of different specimens for histological and cytological analysis

1.1.2. Explain how specimens are received, recorded and stored in the histopathology laboratory

1.2. Aims of Fixation

1.2.1. List and explain the reasons and aims of fixation

1.3. Principles of Fixation

1.3.1. Discuss the various types or methods of fixation

1.3.2. Describe the mode of action of the different classes of fixatives

1.4. Types of Fixatives

1.4.1. Categorize and classify the various types of fixing agents

1.4.2. Identify specific fixation for specific tissue components

1.5. Effects of Fixation

1.5.1. Describe the subsequent effect of fixation on staining and histochemical reactions

1.5.2. Explain and identify the loss of materials during fixation

1.5.3. Describe and explain the different artefacts of fixation

1.6. Practical Aspects of Fixation

1.6.1. Explain and illustrate the practical aspects of fixation

2. Processing and embedding

2.1. Principles of Tissue Processing

2.1.1. Describe the various types of tissue processing methods and their application

2.2. Decalcification

2.2.1. Explain the significance of decalcifying some tissue before processing

2.3. Dehydration

2.3.1. Define and relate dehydration to fixation and clearing

2.3.2. Discuss the different dehydrates in view of advantages and disadvantages

2.4. Clearing

2.4.1. Define and relate the significance of clearing to paraffin wax impregnation

2.5. Paraffin Wax Impregnation and Embedding

2.5.1. Explain the process of impregnation with emphasis on paraffin wax

2.6. Manual and Automatic Tissue Processing

2.6.1. Compare and contrast the advantages and disadvantage of manual and automatic tissue processing

2.6.2. Illustrate the methods/programmes used in automatic tissue processing

2.7. Alternate Embedding

2.7.1. Discuss and explain the other forms of embedding media like resins, gelatin, agar, etc.

3. Decalcification

3.1. Types of Tissue to be Decalcified

3.1.1. Define and describe the process of decalcification

3.1.2. Identify the types of tissue to be decalcified

3.1.3. Discuss the production and application of undeclacified sections

3.2. Decalcifying Agents

3.2.1. Discuss the various types of decalcifying fluids

3.2.2. State and explain the methods for determining end point of decalcification

4. Microtomy

4.1. Uses of Microtomes

4.1.1. Define and describe microtomy and list the uses of microtomes

4.2. Microtome Knives

4.2.1. Define and describe the knife profiles

4.2.2. Compare and contrast the different types of knives used in routine practice

4.2.3. Discuss the theoretical and practical aspects of knife sharpening both manual and automated

4.2.4. Describe the various lubricants and abrasive powders used in knife sharpening

4.3. Types of Microtomes

4.3.1. Describe the various types of microtomes

4.3.2. Compare and contrast the advantages and disadvantages of the different types of microtomes and their uses.

4.4. Practical Section Cutting

4.4.1. Illustrate and demonstrate section cutting on the different types of microtomes

4.5. Faults, Causes and Remedies in Section Cutting

4.5.1. List and discuss the faults, causes and remedies in section cutting

5. Mounting media

5.1. Aqueous Mountants

5.1.1. Discuss the various aqueous mountants used in the histopathology

5.2. Resinous Mountants

5.2.1. Discuss the various resinous mountants used in histopathology

5.2.2. Compare and contrast the advantages, disadvantages of aqueous and resionous mountants

5.2.3. List the uses of aqueous and resinous mountants

5.3. Ringing Media

5.3.1. Discuss the application and significance of ringing media

6. Frozen and related sections

6.1. Frozen Sections

6.1.1. Define and describe cryotomy

6.1.2. Describe the operation and technical aspects of the cryostat principle

6.1.3. Discuss the use and principle of the freezing microtome in producing frozen sections

6.1.4. Explain the application of frozen sections in histopathology

6.2. Freeze Drying

6.2.1. Define and describe the role of freeze drying in frozen section

6.3. Freeze Substitution

6.3.1. Define and describe the role of freeze substitution in frozen sections

7. Principles of tissue staining

7.1. Theory of staining

7.1.1. Explain briefly the origin and theory of staining
7.1.2. Describe the physical properties of staining
7.1.3. Distinguish between direct and indirect staining
7.1.4. Elaborate the factors contributing to dye tissue affinities
7.1.5. Explain the chemical properties of the dye
7.1.6. Categorize dyes according to their classification
7.1.7. Define the different types of staining in line of vital staining, silver impregnation and metachromasia

7.2. Staining equipment

7.2.1. Describe the various types of manual and automatic staining equipment

7.3. Haematoxylin and eosin staining

7.3.1. Discuss the history of haematoxylin
7.3.2. Discuss the principle of haematoxylin and eosin staining, the preparations and uses of various haematoxylin solutions
7.3.3. Explain and discuss the substitutes of haematoxylin
7.3.4. Demonstrate general tissue structure using the haematoxylin and eosin technique

7.4. Special staining techniques

7.4.1. Discuss the role and significance of special staining techniques in diagnostic histopathology

7.5. Histochemistry

7.5.1. Define the term histochemistry and discuss its importance
7.5.2. Discuss the histochemistry of proteins and the techniques used for their identification
7.5.3. Define and discuss the histochemistry of nucleoproteins
7.5.4. Compare and contrast deoxyribonucleic acid and ribonucleic acid
7.5.5. Identify the techniques for the differential and combined demonstration of deoxyribonucleic acid and ribonucleic acid
7.5.6. Classify and discuss carbohydrate histochemistry
7.5.7. Discuss the importance of enzymes histochemistry
7.5.8. Define, classify and discuss lipid histochemistry
7.5.9. Classify and discuss the pigment encountered in normal and pathological conditions
7.5.10. Discuss and demonstrate amyloid in histological sections.

LABORATORY WORK
Refer to current national SOPs

No.	PRACTICAL	RECOMMENDED SOP METHOD
1.	Knife sharpening	Manual and automated
2.	Paraffin was section cutting	Rotary Microtomy
3.	Demonstration and identification of cells and epithelia of body organs	Haematoxylin and Eosin
4.	Identification of connective tissues and cells	• Haematoxylin and Eosin • Van Gieson Technique • Verhoeff's Technique • Gordon and Sweets
5.	Haematoxylin and Eosin	Ehrlichs Alum Haematoxylin
6.	Frozen section cutting	
7.	Ultrathin sectioning	
8.	Surface decalcification and determination of end point	Calcium Oxalate test
9.	Demonstration of argentaffin or enterochromaffin cells	Masson Fontana
10.	Identification of melanin bearing lesions	• Mallory's Bleach • Hydrogen Peroxide Method • Mayer's Bleach
11.	Demonstration of acid mucopolysaccharide	Alcian Blue different pH solutions
12.	Demonstration of carbohydrates	Periodic Acid Schiffs with and without Diastase Digestion
13.	Demonstration of iron	Perl's Technique
14.	Demonstration of DNA and RNA	Methyl Green Pyronin
15.	Demonstration of amyloid	Highman's Congo Red
16.	Demonstration of lipids	• Alcoholic Sudan III/IV • Oil Red O
17.	Demonstration of neuron and nerve fibres	Bielschowsky's Technique

Teaching methods and contact hours:

Lectures	3 hours/Wk
Tutorials	1 hour/Wk
Practicals.	3 hours/Wk

Assessments:

Continuous Assessment 40 %

- Tests 20%
- Assignments 10%
- Practical reports 10%

Examination 60 %
(Written only)

Prescribed text books

2. Stevens, A. and Lowe, J.S. (1992) Human Histology. (2nd Edition) Gower Medical, London.
3. Bancroft, J.D. and Stevens, A. (1995). Theory & Practice of Histological Techniques. 4th Edition. Churchill-Livingstone, Edinburgh.

Recommended text books :

Spicer, S.S. (1987). Histochemistry in Pathologic Diagnosis. Marcel Dekker Inc. New York.

Programme Name	YEAR	Semester #	Module Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**II**	**II**	**Blood Transfusion Science I**	**BTS 2-2**	1.0

AIM:

To provide students with knowledge skills and attitudes that are critical in the practice of Blood Transfusion Science.
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OBJECTIVES
By the end of the module, the student should be able to:

1. Describe the appropriate use of blood and blood products in transfusion medicine.
2. Carry out blood group (serology) compatibility testing and investigate transfusions reaction
3. Describe blood group system and carry out blood group serology
4. Describe the role of transfusion science.
5. Perform compatibility testing.
4. Carry out quality assurance in blood banking

Content:

1.0. Introduction to BTS
- 1.1 Discuss the History of BTS
- 1.2 Discuss the ~~rloe~~ of transfusion science in health care
- 1.3 Discuss the equipment and reagents used in BTS

2.0. Blood group systems

2.1. Genetics of blood groups
- 2.1.1. Discuss the genetics of blood groups

2.2. ABO and Rhesus blood group systems.
- 2.2.1. Explain the ABO blood group system
- 2.2.2. Discuss the rhesus blood group system and Rh typing
- 2.2.3. Interpret blood group serology
- 2.2.4.

I

2.3. Other blood group systems of clinical importance.
- 2.3.1. Explain the significance of other blood group systems e.g. Lewis, MNS, Kell, Duffy etc

2.4. Secretor phenomenon

2.4.1. Define the secretor phenomenon

3.0. Immunohaematology

3.1. Antigens

3.1.1. Explain the concept of antigen reactions

3.2. Antibodies

3.2.1. Explain the concept of antibody reactions

3.2.2. Demonstrate antigen antibody reactions

3.2.3.

3.3. Factors affecting agglutination

3.3.1. Explain the concept of antigen -antibody reactions

3.4. Complement

3.4.1. Explain the role of complement reactions in heamolysis

4.0. Blood collection

4.1. Donor recruitment

4.1.1. State relevant information for donor selection

4.2. Blood donation

4.2.1. haemoglobin screen blood donors

4.2.2. Blood collection process from blood donors

4.3. Blood screening

4.3.1. Explain various screening tests on donated blood

5.0. Compatibility testing

5.1. Antibody screening and identification

5.1.1. Identify and perform antibody screening techniques

5.1.2. Identify allo-antibodies

5.2. Compatibility testing

5.2.1. Describe compatibility testing

5.2.2. Discuss the principle of compatibility testing

5.2.3. Discusscompatibility testing in preventing transfusion reactions

5.3. Monoclonal antibodies

5.3.1. Describe the production of monoclonal antibodies in blood transfusion scienc0e

5.4. Preparation for grouping sera.

5.4.1. Describe techniques of reagent preparation

5.4.2. Employ quality control systems in blood group serology

5.4.3. Prepare and standardise reagent sera

5.5. Direct Antihuman Globulin Test (DAT)
5.5.1. Discuss the principle of DAT
5.5.2. Discuss it use

5.6. Indirect Antihuman Globulin Test (AHG)
5.6.1. Discuss the principle of AHG
5.6.2. Discus its use

5.7. Elution Techniques
5.7.1. Discuss the principle of elution techniques
5.7.2. Discuss the use of elution techniques
5.7.3. Employ elution techniques

5.0 Quality Assurance in BTS
5.1 Internal Quality Assurance
5-2 External Quality Assurance

LABOARTORY WORK
Refer to current national SOPs

No.	TITLE	RECOMMENDED SOP METHOD
1	ABO and Rhesus blood grouping	• ABO Grouping using tube method (BLTR 002/99 • Rhesus blood grouping
2	Reagent red cell preparation	Preparation of 2-5% cell suspension (BLTR 005/99)
3	Preparation of grouping sera	Validation of grouping sera (BLTR 009/00)
5	Haemoglobin estimation (Copper sulphate)	Donor haemoglobin using copper sulphate (BLTR 001/99)
6	Antibody screening	Compatibility testing (BLTR 007/99)
7	Direct Antihuman Globulin Test	Direct Coombs test (BLTR 010/99)
8	Indirect Anti Human Globulin for compatibility testing	Compatibility testing (BLTR 007/99)

Teaching methods and contact hours:
Lectures 3 hour/Wk
Tutorials 1 hour/Wk
Practical 4 hour/Wk

Assessment
Continuos Assessment 40 %
- Tests 20%
- Written assignments 5%
- Practical reports 15%

Examination 60 %

- Written 40%
- Practical 20%

Prescribed text book

1. Boorman, K.E., Dodd, B.E. and Lincoln, P.J. (1988). Blood Group Serology (6th Edn). Churchill-Livingstone, Edinburgh.
2. Turgeon. (2005). Fundamentals of Immunohaematology, Theory and Technique. (2nd Ed). Williams & Wilkins
3. **Geoff Daniels. (2001) Human Blood Groups(2nd Ed) Blackwell.**

Recommended text books:

1. Fleming A.F. (1995). Haematological diseases in the tropics. In: Cook, G.C (Editor). Manson's Tropical Diseases (20th Edn). WB Saunders, Philadelphia
2. Fleming, A.F (1998). Blood Transfusion. In: Lawson, J.B. and Harrison , K.A (Editors). Obstetrics and Gynaecology in the Tropics and Developing Countries. (2nd Edn). W.B. Saunders, Philadelphia.

MODULES IN THE THIRD YEAR

SEMESTER ONE

PROGRAMME NAME	YEAR	SEMESTER #	COURSE NAME	COURSE CODE
BSc Biomedical Sciences	III	I	Hospital Placement	

The hospital placement shall constitute full-time placement at suitably identified hospital and related centres for a period of six months. During this period students are expected to receive training in all major disciplines of Biomedical Sciences. In addition, students are expected to complete a hospital based project supervised by senior Technologists/Scientists in placement centres.

This is a very important part of training and therefore, it is the responsibility of every student to ensure that all aspects of training are adequately covered and the Log Book completed by supervisors at each stage. A student who for whatever reason fails to complete placement training IN FULL shall not be eligible for final examination and will be required to register for practical placement in the next semester and sit for the final examination in the semester succeeding the placement.

In addition to Final theory examinations in various subjects, practical examinations shall be conducted in the following major disciplines:

- **Clinical Biochemistry/Chemical Pathology**
- **Medical Microbiology**
- **Haematology and Blood Transfusion Science (Mixed paper)**
- **Cellular pathology/Histological Techniques**
- **Medical Parasitology**

MODULES IN THE THIRD YEAR

SEMESTER TWO

Programme Name	YEAR	Semester #	Module Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**II**	**II**	**Laboartory Management**	**LMG 3-2**	1.0

AIMS

To equip students with the knowledge and skills to effectively manage laboratory operations in biomedical laboratories.

OBJECTIVES
By the end of the module, the student should be able to:

1. Explian the basic principles management
2. Apply the principles of management in managing the various laboratory resources effectively.
3. Follow national guidelines and policies of the Ministry of Healthto ensure that laboratory operations are in comformity with national guidelines.

1.0 Introduction to laboratory management
- 3.1 Explain the major functions of management
- 3.2 Analyse the various elements of laboratory management
- 3.3 Explain the importance of effective laboratory management

2.0 Laboratory systems, services, and organization
- 2.1 Describe the organisational structure, referral system, and service levels for Zambia's laboratory services
- 2.2 Describe the overall laboratory landscape in Zambia (government, private, NGO)
- 2.3 Describe the basic elements of laboratory design
- 2.4 Demonstrate familiarity with National Policy for Laboratories and other relevant guidelines

3.0 Human resource management
- 3.1 Explain the role of leardership in worker motivation
- 3.2 Determine optimal scheduling of laboratory staff in relation to laboratory workload
- 3.3 Apply knowledge of good personnel practices and supervision
- 3.4 Conduct performance reviews, competency assessments, and evaluation of staff
- 3.5 Understand relevant Labour Law

4.0 Data management

4.1 Maintain a library of laboratory documents (policies, guidelines, SOPs, references, etc.)

4.2 Maintain integrity, organization and confidentially of records (client test results, specimen logs, maintenance logs, inventory logs)

4.3 Create a traceable system of record storage and retrieval.

5.0 Planning and budgeting

5.1 Explain basic principles and functions of financial planning and management

5.2 Evaluate needs for equipment, supplies, and reagents, taking into consideration past patterns, present trends, and future plans in accordance with need and budgetary constraits

6.0 Supply chain management

6.1 Place and monitor orders

6.2 Inventory all equipment, spare parts, supplies, and reagents,

6.3 Apply good inventory management practices (accurate record-keeping, inspection of incoming orders, proper storage, use of bin cards, stock cycling, proper disposal of expired test kits, etc.)

6.4 Monitor consumption rate and inventory levels to determine when and how much to re-order (consumption and quantification)

7.0 Quality management

8.0 Managing laboratory safety

8.1 **Management functions and types**

8.1.1 Discuss the core function of management

8.1.2 Reveal the various styles of management

8.2 **Worker supervision**

8.2.1 Differentiate between a supervisor and a manager

8.2.2 Explain the main functions of a laboratory supervisor

8.2.3 Examine the limitations of a supervisor

8.3 **Problem identification and problem solving models**

8.3.1 Identify the common models in problem identification

8.3.2 Examine strategies followed in finding solutions to problems in a work place

8.3.3 Discuss the role of the laboratories in the National Health care system

9.0 Motivation of staff

9.1 **Definitions, concepts and theories**

9.1.1 Define motivation

9.1.2 Explain the concepts of motivation and satisfaction

9.1.3 Discuss the various theories of motivation

9.2 **Worker motivators and satisfiers**

9.2.1 Explain the meaning of worker motivation, motivators and satisfaction

9.2.2 Recognise that motives are complex and even conflicting

9..3 Motivational techniques in a work environment.

9.3.1 Analyse special motivational techniques with special emphasis on the quality of working life and job enrichment

9.3.2 Examine strategies that may be employed in laboratory worker motivation

10.0 Planning and budgeting

10.1 **Basic financial management in the health service**

10.1.1 Explain the principles used in basic financial management applicable in health services delivery

10.2 **Planning for budgeting**

10.2.1 Employ laboratory information data to plan budget for laboratory supplies and activities

10.2.2 Outline the steps in the planning process

10.2.3 Explain the quantification process in relation to budgeting

10.3 **Capital and recurrent budgets**

10.3.1 Define capital and recurrent budgets

10.3.2 Use financial administration and management system

10.4 **Purpose and function of budgeting**

10.4.1 Explain purposes of budgeting

10.4.2 Outline the function of budgeting

10.5 **Record keeping.**

10.5.1 Describe the process of record keeping

10.5.2 Illustrate the application of record keeping

10.5.3 Show the use of record keeping in planning and budgeting

11.0 Formulation of policy

11.1 **Definition and concepts**

11.1.1 Definition and concepts

11.1.2 Define policy

11.1.3 Explain basic concepts in policy formulation (e.g.) situation analysis)

11.2 **The logical framework approach**

11.2.1 Outline the logical process model of policy formulation

11.2.2 Problem identification (Problem Tree)

11.2.3 Use the problem identification strategy to identify a problem to be solves through policy formulation

11.3 **Objectives, activities, verifiable indicators, outputs and assumptions**

11.3.1 Explain the importance of specifying all the elements that should be observed and achievable in policy execution

11.4 **Project evaluation strategies**

11.4.1 List the common evaluation approaches and strategies

11.4.2 Explain the merits and demerits of each strategy.

Teaching methods and contact hours:

Lectures	2 hours/Wk
Seminars	1 hour/Wk

Assessment:

Assignments	(60%)
Presentations	(40%).

Prescribed text book

3. Pybus R.M. Safety Management Strategy and Practice Butterworth – Heinemann Oxford.
4. Baker F. J. Silvertone and Pallister C.J. (1998) Introduction to Medical Laboratory Technology.

Recommended text books:

Collins C.H. (1988) Laboratory Acquired Infections (2nd Ed.) Butterworth – Heinemann Oxford.

Programme Name	YEAR	Semester #	Course Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**III**	**II**	**Medical parasitology II**	**MP 3-2**	0.5

AIM:

To provide the student with further knowledge and practical skills in the diagnosis and control of parasitic infections in humans

OBJECTIVES

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

1. Identify and describe the life cycles of arthropods of medical importance
2. Describe the pathogenesis, laboratory diagnosis and treatment of the major parasitic infections in Zambia
3. Apply preventive and control strategies against major parasitic diseases in the in the community

Content

1.0 Introduction to Medical Entomology

1.1 Define general terminologies

1.2 Describe the general morphology and classification of insects and arachnids

1.3 Discuss various collection , preservation and mounting techniques

1.4 Prepare reagents used in preservation of arthropods

2.0 Arthropods as vectors of human disease

2.1 Mosquitoes

2.1.1Classify mosquitoes

2.1.2 Describe the morphology and identification of mosquitoes

2.1.3 Describe the Lifecycle and behaviour of mosquitoes

2.1.4 Identify diseases caused by mosquitoes

2.1.5 Apply control strategies against mosquitoes

2.2 Tsetse flies:

2.2.1Classify Tsetse flies

2.2.2 Describe the morphology and identification of Tsetse flies

2.2.3 Describe the Lifecycle and behaviour of Tsetse flies

2.2.4 Identify diseases caused by Tsetse flies

2.2.5 Apply control strategies against Tsetse flies

2.3 Louse

2.3.1 Classify Louse
2.3.2 Describe the morphology and identification of louse
2.3.3 Describe the Lifecycle and behaviour of louse
2.3.4 Identify diseases caused by louse
2.3.5 Apply control strategies against louse

2.4 Tick

2.4.1 Classify Ticks
2.4.2 Describe the morphology and identification of ticks
2.4.3 Describe the Lifecycle and behaviour of ticks
2.4.4 Identify diseases caused by ticks
2.4.5 Apply control strategies against ticks

2.5 Flea

2.5.1 Classify Fleas
2.5.2 Describe the morphology and identification of Fleas
2.5.3 Describe the Lifecycle and behaviour of fleas
2.5.4 Identify diseases caused by flies
2.5.5 Apply control strategies against fleas

2.6 Infestation of arthropods

2.6.1 Describe infestation of Dipterans (myiasis), fleas, mites and lice
2.6.2 Describe infestation of Arachnids as venomous arthropods

2.7 Pathogenic mechanisms of arthropods

2.7.1 Outline the pathogenic mechanisms of arthropods

3.0 Malaria

3.1 Discuss the epidemiology: Geography and patterns of infection
3.2 Discuss the role of histidine rich protein
3.3 Describe Control strategies against malaria
3.4 Discuss various diagnostic challenges of malaria.
3.4.1 Symptomatic
3.4.2 Laboratory methods
3.4.2.1 Microscopy
5.4.3.2 Formats of Rapid diagnostic Tests
5.4.3.3 QBC

4.0 Schistosomiasis

4.1 Discuss the epidemiology: Geography and patterns of infection
4.2 Describe control strategies against Schistosomiasis

5.0Trypanosomiasis

5.1 Human African Trypanosomiasis:
5.1.1 Discuss the epidemiology: Geography and patterns of infection
5.1.2 Outline the challenges of diagnosis
5.1.3 Discuss veterinary trypanosomiasis

5.1.4 Describe control strategies of Trypanosomiasis

LABORATORY WORK
Refer to SOP

NO.	TITLE
1	Preparation of Stock Giemsa and Buffer solution
2	Preparation of thick and thin smears of malaria parasites
3	Malaria species identification and in thin and thick smears
4	Quantification of malaria parasites
5	Storage of MP slides and RDTs Examination of blood for malaria
6	RDTs-HRP II and Enzyme based formats
7	Preparation and examination of wet mount smears of trypanosomes
8	Processing of CSF of trypanosomes
9	Giemsa staining and examination of trypanosomes
10	Examination of stool for Schistosome ova using wet mount technique
11	Examination of stool for Schistosome ova using Kato-Katz technique
12	Examination of urine for schistosome ova using sedimentation method

Field Study:

1. Collection, preservation and mounting of Mosquitoes
2. Collection, preservation and mounting of Tsetse fly
3. Collection and Identification of *Bolinus* species and *Biomphalaria* species

Teaching methods and contact hours

- Lectures 3 Hours/Week
- Laboratory practical/Field study 3 Hours/Week

Assessment Methods

- Continuous assessment 40%

Tests	20%
Laboratory practical	15%
Assignments	5%
• Examination	60%
Written	40%
Practical	20%

Prescribed textbooks

1 Markell, E.K, Voge, M and John, D.J (2006). *Medical Parasitology*. W.B. Saunders Company, Philadelphia.

2 Ash R.L.and Orihel C.T.,(1997),*Atlas of Human Parasitology*,4th edition, American society of Clinical pathology press, Chicago.

3 Despommier, D.D, Gwadz, R.W and Hotez, P.J (1995). *Parasitic Diseases*. Springer-Verlag, Berlin

Recommended references

3. Peters, W and Gilles, H.M (1989). *A colour atlas of Tropical Medicine and Parasitology* (3rd Edition). Wolfe Medical Publications Ltd., Berlin

4. Manson-Bahr, P.E.C. and Bell, D.R (1998). *Manson's Tropical Diseases*. (14th Edition). ELBS, Bailliere-Tindall, London

AIM:

To Provide the student with further knowledge and practical skills in the diagnosis and control of parasitic infections in humans

OBJECTIVES

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

4. Identify and describe the life cycles of arthropods of medical importance
5. Provide information on the pathogenesis and treatment of the major parasitic infections to various clinical staff.
6. Describe preventive and control strategies against major parasitic diseases in the community.

Content

1.0 Introduction to Medical Entomolgy
1.1 General classification of insects:
1.2 General Morphology of arthropods

2.0 Arthropods as vectors of human disease
2.1 Mosquitoes;

2.1.1Classify mosquitoes,
2.1.2 Describe the morphology and identification of Tsetse flies
2,1,3 Describe the Lifecycle, behaviour and control of Tsetse flies

2.2 Tsetseflies:
2.2.1Classify Tsetse flies,
2.2.2 Describe the morphology and identification of Tsetse flies
2,2,3 Describe the Lifecycle, behaviour and control of Tsetse flies

2.3 Louse-borne
2.3.1 Classify Louse,
2.3.2 Describe the morphology and identification of Louse

2,3,3 Describe the Lifecycle, behaviour and control of Louse

2.4 Tick borne
2.4.1Classify Ticks,
2.2.2 Describe the morphology and identification of Ticks

2,2,3 Describe the Lifecycle, behaviour and control of Ticks

2.5 Flea borne
2.5.1Classify Fleas,
2.2.2 Describe the morphology and identification of Fleas
2,2,3 Describe the Lifecycle, behaviour and control of Feas

3.0 Vector control

3.1 Various collection methods, preservation and mounting

3.2 Principles and methods

4.0 Pathogenic mechanisms of arthropods

4.1 Blood sucking dipterans

4.2 Infestation: Dipteran (myiasis), fleas ,mites and lice

4.3 Venomous arthropods: Arachnids

4.4 Mechanical injury

5.0 Malaria;
5.1 Epidemiology
5.2 Control strategies

6.0. Diagnostic challenges in malaria.

6.1.Symptomatic, laboratory methods (Microscopy,

6.2 Formats of Rapid diagnostic Tests, QBC).

7.0 Schistosomiasis
7.1. Epidemiology: Geography, and patterns of infection
7.2. Control strategies

8.0. Trypanpsomiasis

8.1 Human African Trypanosomiasis:
Epidemiology: Geography, and patterns of infection, challenges of diagnosis.
8.2 Veterinary trypanosomiasis

8.3 Control strategies of Trypanosomiasis, Tsetse control

9.0 Collection and preservation of specimens.

10.0 Reagents for preserving specimens for parasitological investigations

11.0 Organisation of the Parasitology laboratory

11.1 The organisation in a parasitology Laboratory.
11.2 Safety in the Parasitology laboratory

Teaching methods and contact hours

- Lectures 3 Hours/Week
- Laboratory practicals 3 Hours/Week

Assessment Methods

- Continuous assessment 40%
  Tests
  Laboratory practicals
  Assignments
- Examination 60%
  Written

Laboratory practical

Refer to current national SOPs

A.Practicals in Malaria

Diagnosis: Preparation of Stock Giemsa and Buffer solutions, storage, cleaning of slides, thin and thick, storage of MP slides, and RDTs, QA
Species identification in thick and thin smears, parasite quantifications
RDTS- HRP II and Enzyme based formats
Field Study: Mosquitoes

B. Practicals inTrypanosomiasis

Diagnosis: Preparation of wet smears, Giemsa staining of trypanosomes,
Processing CSF for trypanosomes

Vector identification

Practicals in Schistosomiasis.

Diagnosis: eggs in wet preparations and Kato-Katz technique, urine sedimentation

Programme Name	YEAR	Semester #	Module Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**III**	**II**	**Haematology & Blood Transfusion Science II**	**HBT 3-2**	1.0

Aim:

Equip students with the knowledge and skills necessary in the diagnosis of leukocytes, haemostatic mechanisms and the use of modern blood banking technologies for safe blood transfusion practice.

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

1. Describe the benign and malignant disorders of leukocytes
2. Recognise common benign and malignant disorders of leukocytes from the examination of blood films.
3. Describe the disorders of haemostasis
4. Perform appropriate laboratory tests to detect disorders of haemostasis
5. Understand the management of the haematology laboratory and blood transfusion services.
6. Describe the appropriate use of blood and blood products in transfusion practice
7. Perform blood grouping, compatibility testing and investigate transfusion reactions
8. Prepare components of blood for transfusion
9. Explain the principles of quality assurance and quality control in blood Transfusion Services

Content

1. Anaemias

1.1 Definition and Classification of Anaemias

1.1.1 Morphological
1.1.2 Kinetics
1.1.3 Pathological

1.2 Normocytic normochromic

1.2.1 Define normocytic normochromic anaemia
1.2.2 Discuss normocytic normochromic anaemia

1.3 Microcytic anaemias

1.3.1 Define microcytic hypochromic anaemia
1.3.2 Discuss microcytic hypochromic anaemia

1.4 Macrocytic anaemias

1.4.1 Define macrocytic anaemia
1.4.2 Discuss features of macrocytic anaemia including megaloblastic changes

1.5 Cytopaenia and aplastic anaemia

1.5.1 Define the features of pancytopaenia
1.5.2 Define the features of aplastic anaemia

1.6 Haemoglobinopathies

1.6.1Define haemoglobinopathies
1.6.2 Describe sickle cell disease
1.6.3 Describe thalassaemia disease
1.6.4Mention other types of haemoglobinopathies e.g. HbC, HbD diseases

1.7 **Haemolytic anaemias**

1.7.1 Define haemolytic anaemia
1.7.2 Describe the classification of haemolytic anaemias
1.7.3 Discuss congenital haemolytic anaemias
1.7.4 Discuss acquired haemolytic anaemias
1.7.5Discuss the differential diagnosis of haemolytic anaemias

2.0 Leukocyte functional disorders

2.1 Acute Leukaemias

2.1.1 Classify acute leukaemias
2.1.2 Describe the classification of acute myeloid leukaemia according to the FAB classification
2.1.3 Discuss the aetiology of acute myeloid leukaemia
2.1.4 Describe the pathology of acute myeloid leukaemia
2.1.5 Identify acute myeloid leukaemias
2.1.6 Describe the classification of acute lymphoblastic leukaemia according to the FAB classification
2.1.7 Discuss the aetiology of acute lymphoblastic leukaemia
2.1.8 Describe the pathology of acute lymphoblastic leukaemia
2.1.9 Discuss the diagnosis of acute leukaemia
2.1.10 Discuss cytochemical tests used in the diagnosis of acute leukaemias
2.1.11 Discuss briefly cell markers of diagnostic value to acute leukaemia
2.2.12 Mention chromosome studies
2.1.13 Recognise acute leukaemias
2.1.14 Identify acute myeloid leukaemias

2.2 Chronic Leukaemias

2.2.1 Describe chronic lymphocytic leukaemia
2.2.2 Describe prolymphocytic leukaemia
2.2.3 Describe lymphomas
2.2.4 Describe the Hairy cell leukaemia
2.2.5 Describe the aetiology of chronic leukaemia
2.2.6 Describe the pathology of chronic leukaemia
2.2.7 Discuss the cytochemistry of chronic leukaemia
2.2.8 Discuss cell markers of diagnostic value to chronic leukaemia
2.2.9 Mention chromosome studies

2.3 Non leukaemic Myeloproliferative disorders

2.3.1 Describe Polycythaemia Vera
2.3.2 Describe secondary polycythaemia
2.3.3 Describe myelofibrosis
2.3.4 Describe thrombocythaemia
2.3.5 Discuss the pathology of non leukaemic myeloproliferative disorders
2.3.6 Discuss the diagnosis of non leukaemic myeloproliferative disorders
2.3.7 Discuss the cytochemistry of non leukaemic myeloproliferative disorders

2.4 Myelodysplastic disorders

2.4.1 Describe the FAB classification of myelodsplastic disorders
2.4.2 Describe refractory anaemia with erythroid hyperplasia
2.4.3 Describe refractory anaemia with ringed sideroblasts
2.4.4 Describe refractory anaemia with excessive blasts -RAEB
2.4.4 Describe chronic myelomonocytic leukaemia with RAEB
2.4.5 Describe refractory anaemia in transformation
2.4.6 Discuss the diagnosis of myelodysplastic disorders

3.0 Haemostasis and thrombosis

3.1 Normal coagulation

3.1.1 Describe the features of normal haemostatic mechanism
3.1.2 Describe the intrinsic pathway
3.1.3 Describe the extrinsic pathway
3.1.4 Describe the kinetics of coagulation
3.1.5 Describe the features of the fibrinolytic system
3.1.6 Discuss the role of coagulation in haemostasis

3.2 Platelet disorders

3.2.1 Explain thrombocytopenia
3.2.2 Explain Bernard Soulier Syndrome
3.2.3 Describe Glanzman's disease
3.2.4 Describe storage pool disease

3.2.5 Describe Von Willebrand disease
3.2.6 Describe acquired defects of secondary aggregation

3.3 Disorders of coagulation and thrombosis

3.3.1 Describe vascular abnormalities of factors VIII and IX (Haemophilia A and B)
3.3.2 Discuss inherited abnormalities of the contact factor
3.3.3 Discuss abnormalities of fibrinogen
3.3.4 Discuss inherited deficiencies of factor II, V, VII and X
3.3.5 Discuss factor XIII deficiency
3.3.6 Mention other rare hereditary coagulation factor deficiencies
3.3.7 Discuss the mechanism of Disseminated Intravascular Coagulation (DIC)

4.0 Transfusion therapy

4.1 Red blood cells

4.1.1 Define packed red blood cells
4.1.2 Discuss preparation and use of packed red blood cells

4.2 Plasma

4.2.1 Define fresh frozen plasma
4.2.2 Discuss preparation and use of fresh frozen plasma
4.2.3 Discuss storage of fresh frozen plasma

4.3 Cryoprecipitate

4.3.1 Define cryoprecipitate
4.3.2 Explain preparation and use of Cryoprecipitate
4.3.3 Discuss storage Cryoprecipitate

4.4 Leucocytes

4.4.1 Define Leucocyte concentrate
4.4.2 Explain preparation and use of Leucocyte concentrate
4.4.3 Discuss storage Leucocyte concentrate preparations

4.5 Platelets

4.5.1 Define platelets concentrate
4.5.2 Discuss preparation of and use platelets concentrate
4.5.3 Discuss storage of platelets concentrate

4.6 Factor rich plasma

4.6.1 Define factor rich plasma
4.6.2 Define anti-haemophilic factor (Factor VIII)
4.6.3 Define Christmas factor (Factor IX) concentrate
4.6.4 Discuss storage and use of factor rich plasma

4.7 Other blood products

4.7.1 Define other blood products: leucocyte poor blood, Vaccines, immunoglobulins, blood grouping reagent, washed red blood cells

4.7.2 Discuss storage and use of other blood products

5.0 Adverse effects of blood transfusion.

5.1Transfusion reactions and its investigations

5.1.1Define transfusion reactions

5.1.2 Discuss acute adverse effects of transfusion

5.1.3 Discuss delayed adverse effects of transfusion

5.1.4 Discuss records of transfusion complications

5.1.5 Discuss investigative procedure for transfusion reaction

5.2 Hazards of blood transfusion

5.2.1Discuss laboratory investigative procedure hazards associated with red blood cell transfusion

5.2.2 Outline hazards associated with transfusion of other blood products

5.2.3 Discuss ways of minimising hazards of blood transfusion

5.3 Medical legal aspects of blood transfusion science

5.3.1 Discuss medical legal aspect of Blood transfusion e.g. litigation, consent to transfusion, rights of the patient and paternity testing

5.3.2 Ethics in BTS

6.0 Haemolytic disease of the newborn (HDN)

6.1 Mechanism of haemolytic disease of the new-born

6.1.1Define ABO HDN

6.1.2 Define Rh HDN

6.1.3 Discuss the mechanism of ABO HDN

6.1.4 Discuss the mechanism of Rh HDN

6.2 Investigation of haemolytic disease of the new-born

6.2.1 Discuss the investigations carried out for ABO HDN

6.2.2 Discuss the investigations carried out for Rh HDN

6.3 Prevention and treatment of haemolytic disease of the new-born

6.3.1 Explain how ABO HDN can be prevented

6.3.2 Explain how Rh HDN can be prevented

6.3.3 Discuss treatment and management of Rh HDN

7.0 **Recent developments in Blood Transfusion Science**

7.1 Haemovigilance (SHOT)

7.2 Hospital transfusion committees (HTCs)

7.3 Recombinant technology in BTS

8.0 Quality assurance:

8.1 Internal Quality control

8.1.1 Define internal quality control

8.1.2 Perform internal quality control

8.2 External quality assessment

8.2.1 Define external quality assessment

8.2.2 Perform external quality assessment

LABORATORY WORK

Refer to current national SOPs

No.	TITLE	RECOMMENDED SOP METHOD
1	Examination of blood films	Manual differential count
2	Sickling/solubility test	Solubility test
3	Haemoglobin electrophoresis	Haemoglobin electrophoresis Cellulose acetate paper
4	Fetal Haemoglobin estimation (Betkes')	Hb F estimation
5	Osmotic fragility	Osmotic fragility
6	Glucose 6 Phosphate Dehydrogenase Assay (G6PD)	Glucose 6 phosphate dehydrogenase assay
7	Bone marrow immunochemistry	• Bone marrow May-Grunwald Giemsa stain • Neutrophil alkaline phosphatase • Myeloperoxidase • Sudan Black B • Naphthyl acetate esterase • Perl's Prussian Blue for haemosiderin
8	Bleeding time	Bleeding time Ivy's method
9	Prothrombin Time and correction tests	Prothrombin Time test
10	Activated Partial Prothrombin Time and correction tests	• Activated Partial Prothrombin Time • Factor VIII assay • Factor IX assay • Fibrinogen assay

11	Preparation of blood products	• Preparation of packed red cells using sedimentation method • Collection of blood for component preparation • Platelet preparation • Preparation of fresh frozen plasma • Preparation of cryoprecipitates • Use of transfer pack
12	Visit to ZNBTS in Lusaka	
13	Tests in transfusion reaction	• Investigating a transfusion reaction • Direct Coombs tests • Investigating an incompatibility
14	Tests in haemolytic disease of the new-born	• ABO and RH blood grouping using the tube method • Direct Coombs test

Teaching methods and contact hours:

Lectures	3 hour/Wk
Tutorials	1 hour/Wk
Practicals	4 Hour /Wk

Assessment:

Continuous assessment		40%
• Practical	25%	
• Tests	10%	
• Assignments	5%	
Examination		60%
• Written	40%	
• Practical	20%	

Prescribed text books

1. Dacie, J.V. Lewis, S.M (1994). Practical Haematology (6th Edition). Churchill-Livingstone, Edinburgh.
2. Hall, R and Malia. , R.G. (1991). Medical Laboratory Haematology (2nd Edition). Butterworth-Heinemann, Oxford.
3. Turgeon . Fundamentals of Immunohaemtology. Theory and technique (2nd Ed) Williams &Wilkins
4. Petz and swisher. (2003). Clinical practice of Transfusion Medicine, (2nd Ed). Churchill livingstone
5. Hillyer, Silberstein, Ness Anderson. (2003). Blood Banking and Transfusion Medicine, Basic Principles & Practice

Recommended text books:

1. Hoffbrand, A.V and Pettit,J.E (1993). Essential Haematology (3rd edition). Blackwell Scientific Publications, Oxford.
2. Mollison, P.L., Engelfriet, C.P. and Conteras, M. (1997). Blood Transfusion in Clinical Medicine (10th Edn). Blackwell Scientific, Oxford.
3. Fleming, A.F. (1998). Blood Transfusion. In: Lawson J.B. and Harrison, K.A. (eds) Obstetrics and Gynaecology in the Tropics and Developing Countries. (2nd Edn). W.B. Saunders, Philadelphia.
4. Zambia National Blood Transfusion Policy.

Programme Name	YEAR	Semester #	Module Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**III**	**II**	**Cellular Pathology II**	**PTH 322**	1.0

AIM:

To provide students with knowledge and skills necessary to perform procedures in cytopathological investigations, Post-mortem and Museum techniques.

OBJECTIVES:

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

1. Investigate and describe different pathological states.
2. Use routine, special stains and other identification techniques in diagnostic cytopathology
3. Demonstrate basic understanding of post-mortem and museum techniques

CONTENT:

1.0 Cytology

1.1 Collection, preparation and fixation of specimens
1.2 Gynaecological cytology
1.3 Non-gynaecological cytology
1.4 Fine Needle Aspiration

2.0 Special Histological Techniques
2.1 Immunocytochemistry
2.2 Enzymes histochemistry
2.3 Autoradiography
2.4 Immunofluorescence techniques
2.5 Molecular techniques

3.0 Electron Microscopy
3.1 Theoretical aspects and instrumentation
3.2 Tissue preparation, sectioning and staining
3.3 Specialised techniques
3.4 Diagnostic uses

4.0 Post-mortem and Museum Techniques
4.1 Equipment for performing an autopsy
4.3 Museum techniques
4.4 Forensic techniques

Teaching Methods and Contact Hours

- Lectures 3 hours/week
- Tutorials 1 hour/week
- Laboratory practicals 3 hours/week
- Self directed group learning Extra curricula

Assessment Methods

- Continuous assessment 40%
  Tests
  Laboratory practicals
  Assignments
- Examination 60%
  Written
  Laboratory practical
  Viva voce

Laboratory work:
Refer to current national SOPs

No.	TITLE	RECOMMENDED SOP METHOD
1	Localisation of enzymes	Acetone fixation 4°C Azo coupling
2	Demonstration of common tumour markers	Immuno-florescence techniques
3	Immuno-typing of tumours	
4	Staining of cervical and non-gynaecological smears with Papanicolaou and Romanowsky	

	stains.	
5	Preservation of museum specimen	

Prescribed textbooks

Cook, D.J (1999). Biomedical Sciences Explained: Cellular Pathology. Butterworth-Heinemann, Oxford. ISBN: 0 7506 3111 2

Bancroft, J.D and Stevens, A (1995). Theory and Practice of Histological Techniques (4th Edition). Churchill-Livingstone, Edinburgh. ISBN: 0 443 03559 8

Bancroft, J.D and Cook, H.C (1984). Manual of Histological Techniques. Churchill-Livingstone, Edinburgh. ISBN: 0 443 02870 2

Recommended references

1. Baker, F.J, Silverstone, R.E and Pallister, C.J (1998). Introduction to Medical Laboratory Technology (7th Edition). Butterworth-Heinemann, Oxford. ISBN: 0 7506 2190 7

2. Kiernan, J.A (1999). Histological and Histochemical Methods: Theory and Practice (3rd Edition). Butterworth-Heinemann, Oxford. ISBN: 0 7506 3106 6

3. Spicer, S.S (1987). Histochemistry in Pathologic Diagnosis. Marcel Dekker Inc, New York

Stevens, A and Lowe, J (1992). Human Histology (2nd Edition). Gower Medical, London

Teaching methods and contact hours:

Lectures	2 hour/Wk
Tutorials	1 hour/Wk
Practical	4 hour/Wk

Assessment

Continuous assessment		40 %
• Practical reports	20 %	
• Tests	10 %	
• Assignments	10 %	

Examination		60 %
• Written	40%	
• Practical	20%	

Prescribed text books

1. Wheater, P.R., Burkitt, H.G. Stevens, A. and Lowe, J.S. (1995). Basic Histopathology. Churchill-Livingstone, Edinburgh.
2. Pallister (ed) (1999) Biomedical Sciences Explained: Histopathology. Butterworth London.

Recommended text books:

1. Chandrasoma, P. and Taylor, C.R. (1995). Concise Pathology. Prentice-Hall, New Jersey.
2. Curran, P. (1992). Colour Atlas of Histopathology. Oxford University Press, Oxford.
3. Spicer,S.S. (1987). Histochemistry in Pathologic Diagnosis. Marcel Dekker Inc. New York.

Programme Name	YEAR	Semester #	Module Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**III**	**II**	**Clinical Biochemistry**	**CBC 312**	1.0

AIM:

To impart knowledge and skills in the analysis of clinical specimens and the interpretation of results.

OBJECTIVES:

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

1. Perform organ specific investigations.
2. Carry out investigations on hormone levels in blood and explain the significance of the results.
3. Explain the significance of porphyrins and bile pigments and analyse samples for these pigments in cases of disease states.
4. Identify drugs and poisons and carry out assays to determine their concentrations in samples.
5. Carry out thorough quality control procedures to ensure high quality, reliable test results.

CONTENT:

1.0. ORGAN SPECIFIC INVESTIGATIONS

1.1. Cardiac Enzymes

1.1.1. Explain the main causes of myocardial infarction (MI)
1.1.2. Explain the significance of creatine kinase in the diagnosis of MI
1.1.3. Identify the tissue sources of creatine kinase
1.1.4. Describe the isoenzyme of creatine kinase (CK-MM, CK-MB CK-BB)
1.1.5. Explain the significance of lactate dehydrogenase in the diagnosis of heart disease
1.1.6. Identify the tissue sources of the enzymes
1.1.7. Describe the isoenzyme of lactate dehydroglunase (LD-1[HHHH], LD2 – [MMMM]), LD3 (HHMM), LD-4 (HMMM), AND LD5 – (MMMM)
1.1.8. Explain the significance of aspartate transaminase in the diagnosis of heart disease.
1.1.9. Identify the tissue sources of aspartate transaminase

1.2. Liver Investigations

1.2.1. Describe the macro and micro structure of the liver.

1.2.2. Explain the major functions of the liver
1.2.3. Explain the bile pigment metabolism
1.2.4. Discuss the causes and effects of jaundice
1.2.5. Discuss the causes and effects of cirrhosis
1.2.6. Highlight the tumours of the liver
1.2.7. Discuss the effects of drug and alcohol related disorders on the liver
1.2.8. Carry out tests to assess liver function (bilirubin, urobilinogen, bile acid, enzymes etc.)

1.3. Kidney Investigations

1.3.1. Describe the macro and microscopic anatomy of the kidney
1.3.2. Explain the major functions of the kidney
1.3.3. Explore the causes and effects of glomerular diseases
1.3.4. Explore the causes and effects of tubular diseases
1.3.5. Describe the causes and effects of urinary tract infection and obstruction
1.3.6. Discuss renal calculi and its effects
1.3.7. Explore the main causes and effects of renal failure
1.3.8. Describe the effects of diabetic nephropathy and renal hypertension
1.3.9. Carry out tests to investigate the various diseases of the kidney

1.4. Pancreatic Investigations

1.4.1. Describe the basic structure of the pancreas
1.4.2. Explain the main functions of the pancreas
1.4.3. Explore the causes and effects of cystic fibrosis
1.4.4. Explore the causes and effects of pancreatic carcinoma
1.4.5. Discuss the causes and effects of acute and chronic pancreatitis
1.4.6. Carry out tests to investigate the various pancreatic conditions (secretion test, faecal fat, sweat test, electrolytes, enzymes, where possible)

2.0. ENDOCRINOLOGY

2.1. Endocrine and Exocrine Glands

2.1.1. Explore the various components of the endocrine system (hypothalamus, anterior and posterior pituitary, thyroid parathyroid, adrenal glands, islets of langerhans reproductive system)
2.1.2. Distinguish between the endocrine and exocrine function
Carry out practicals

2.2. General Characteristics of Hormones

2.2.1. Define hormones
2.2.2. Explain the chemical nature of hormones
2.2.3. Describe the mechanism of hormone action
2.2.4. Explain hormone control

Carry out practicals

2.3. Pituitary Hormones

2.3.1. Outline the structure of the pituitary (posterior/anterior)
2.3.2. Describe the hormones of the anterior pituitary (ACTH, GH, protection TSH, LH, FSH)
2.3.3. Explain the functional roles of anterior pituitary hormones
2.3.4. Explain abnormal conditions associated with these hormones
2.3.5. Describe the hormones of the posterior pituitary (ADH, oxytoxin)
2.3.6. Explain abnormal conditions associated with these hormones
2.3.7. Carry out practicals

2.4. Thyroid Hormones

2.4.1. Outline the structure of the thyroid and parathyroid gland
2.4.2. Describe the nature and biosynthesis of hormones produced by the thyroid and parathyroid hormone (PTH)
2.4.3. Explain the functional roles of thyroid hormones.
2.4.4. Explain the abnormal conditions associated with thyroid hormones.
2.4.5. Carry out practicals

2.5. Pancreatic Hormones

2.5.1. Outline the basic structure of the pancreas
2.5.2. Explain the function of the endocrine pancreas
2.5.3. Explain the function of the exocrine pancreas
2.5.4. Explain the abnormal conditions of the pancreas
2.5.5. Carry out practicals

2.6. Adrenal Hormones

2.6.1. Outline the structure of the adrenal gland
2.6.2. Describe the biosynthesis and secretion of the mineral corticoids (ACTH)
2.6.3. Describe the biosynthesis and secretion of glycocorticoids (cortisol)
2.6.4. Describe the biosynthesis and secretion of catecholamines (epinephrine and nor-epinephrine)
2.6.5. Describe the abnormalities associated with adrenal hormone secretions
2.6.6. Carry out practicals

2.7. Sex Hormones

2.7.1. Identify the organs associated with sex hormone production
2.7.2. Enumerate the various sex hormones
2.7.3. Detail the roles of various male and female hormones
2.7.4. Discuss abnormalities associated with sex hormones

2.7.5. Endocrine Tests
2.7.5.1. Perform tests to investigate various endocrine diseases/abnormalities

3.0. Porphyrins and bile pigments

3.1. Structure of Porphyrins
3.1.1. Describe the chemical structure of porphyrins

3.2. Biosynthesis of Porphyrins
3.2.1. Explain the biosynthesis of porphyrins

3.3. Bile Pigments
3.3.1. Explain the biosynthesis of bile pigments
3.3.2. Explain significance of bile pigments

3.4. Clinical Significance
3.4.1. Explain the significance of porphyrins and bile pigments
3.4.2. Perform tests to investigate porphyrias and bile pigment abnormalities

4.0. Toxicology

4.1. Classification of Compounds
4.1.1. Give a list of various poisons and toxic compounds
4.1.2. Classify compounds in terms of their chemical nature and structure

4.2. Therapeutic Drug Monitoring
4.2.1. Define a Therapeutic Drug (TD)
4.2.2. Identify various therapeutic drugs
4.2.3. Outline the action of therapeutic drugs
4.2.4. Discuss the role of the Laboratory in Therapeutic Drug Monitoring (TDM)
4.2.5. Carry out Tests to monitor levels of various therapeutic drugs in body fluids

5.0. Quality control of biochemical tests

5.1. Selection and Evaluation of Biochemical Assay Methods
5.1.1. Identify criteria for selection of biochemical methods
5.1.2. Use appropriate methods for evaluation of biochemical assay methods

5.2. Calibration and Quality Control Materials
5.2.1. Identify various calibration and quality control materials
5.2.2. Prepare some quality control materials (pooled germ controls)
5.2.3. Use various quality control and calibration materials in routine work

5.3. Internal Quality Control

5.3.1. Explain the value of internal quality control (IQC)

5.3.2. Employ IQC in the laboratory

5.4. External Quality Assessment

5.4.1. explain the value of external quality assessment (EQA)

5.4.2. participate in the EQZ schemes

5.5. Determination of Sensitivity, Specificity and Selectivity of Assay Methods

5.5.1. Define sensitivity, specificity and selectivity

5.5.2. Explain methods of assessing sensitivity, specificity and selectivity of assay methods

6.0. Quality assessment

6.1. Definition of Quality Assessment

6.1.1. Define quality assessment

6.2. Definition of Quality Control

6.2.1. Define quality control

6.3. Precision and Accuracy

6.3.1. Define precision and accuracy

6.3.2. Explain the significance of precision and accuracy

6.4. Standard Deviation (CV) and Coefficient of Variation (CV)

6.4.1. Define the SD and CV

6.4.2. Employ the formula to calculate SD and CV

6.4.3. Interpret the meaning of SD and CV

LABORATORY WORK

Refer to current national SOPs

No.	TITLE	RECOMMENDED SOP METHOD
1.	Carry out Cardiac enzyme estimated	Kit methods
2.	Carry out liver function tests: • Total Protein • Albumin • Bilirubin • Urobilinogen • Enzymes • Bile Pigments etc.	
3.	Carry out kidney function test: • Creatinine • Urea • Calculi • Urinalysis etc.	Jaffe's reaction DAM method Qualitative methods Dry Chemistry,

	• Electrolytes	
4.	Carry out pancreatic function tests: • Amylase • Faecal fat • Electrolytes etc.	• Sarcharogenic method • Emission photometry, titration
5.	Carry out endocrine function tests: • T3 T4 • T54 • Cortisol etc.	• Radioimmuno Assay (RIA) • Immuno Radio Metric Assay (IRMA) • Chemical methods • Immuno fluorescent method
6.	Detect porphyria and bile pigments	Qualitative (chemical) methods
7.	Perform Therapeutic Drug Monitoring (TDM) • Paracetamol • Aspirin • Digoxin • Theophylline • Phenorbabitone	• Chemical methods • Immuno Fluorescent methods

Teaching methods and contact hours:

Lectures	3 hours/Wk
Tutorials	1 hour/Wk
Practicals	4 hours/Wk

Assessment:

Continuous Assessment		40 %
• Practical reports	20 %	
• Tests	15 %	
• Assignments	5 %	
Examination		60 %
• Written	40 %	
• Practical	20 %	

Prescribed text books

1. Zilva, T.F., Pannal, R.P., and Mayne (1988). Clinical Chemistry in Diagnosis and Treatment (5th Edition). Lloyd-Luke Medical Books, London.
2. Varley, H., Gowenlock, A.H., and Bell, M (1984) Practical Clinical Biochemistry (5th Edn). Volume 1. General Topics and Commoner Tests. William Heinemann Medical Books, London.

Recommended text books:

1. Marshall, W.J. (1995). Clinical Chemistry (3rd Edition) Mosby, London

2. Stryer, L (1995). Biochemistry (4th Edition). W.H Freeman and Co. New York.
3. Zubay, L.L., Parsons, W.W., and Vance, D.E. (1995) Principles of Biochemistry. N.M.C. Brown, Dupuque.

Programme Name	YEAR	Semester #	Course Name	Course Code	Module Weight
Diploma-Biomedical Sciences	**III**	**II**	**Medical Microbiology III**	**MM 3-2**	1.0

AIM:
To equip students with knowledge and skills necessary for carrying out clinical diagnostic and Public Health microbiology

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

1. Classify viruses and carry out investigations to detect viral infections.
2. Classify fungi and carry out investigations to diagnose fungal diseases.
3. Apply Public Health techniques in the examination of food and water.

CONTENT:

A.VIROLOGY

1.0 Introduction to Virology

1.1 General properties of viruses
1.2 Classification and nomenclature of viruses
1.3 Structure and composition of viruses
1.4 Viral genetics and evolution
1.5 Viral replication
1.6 Viral transmission, pathogenesis and persistent infections
1.7 Host responses to viral infections
1.8 Viral oncogenesis
1..9Collection, Transportation and processing of Specimens
1.10 Laboratory diagnosis of viral diseases
1.11Control of viral infections and diseases
1.12 Chemotherapy-modes of action of anti-retrovirals

2.0 Common viral pathogens

2.1Acute Respiratory Viruses
2.2Gastro enteric viruses
2.3Herpes Viruses
2.4Viral Hepatitis
2.5Haemorrhagic Viruses
2.6Measles, Chicken Pox, Varicella, Zoster, Rubella and Herpes virus
2.7CNS viruses
2.8Human Retroviruses
2.9Zoonotic Viruses (Anthropod Borne Viruses)

2.10 Emerging viruses
2.11 Prion diseases

3.0 HIV and AIDS
3.1 Origin and historical perspectives
3.2 Structure of HIV, life cycle and transmission
3.3 Pathogenesis, pathology and opportunistic diseases
3.4 Laboratory diagnosis and patient monitoring
3.5 Challenges in HIV and AIDS-diagnosis, treatment and vaccination
3.6 Epidemiology, impact and control strategies
3.7 Diagnosis and management of HIV and AIDS in paediatrics

B Mycology

4.0 Introduction to Mycology
4.1 Characteristics of fungi
4.2 Classification of fungi
4.3 Disease mechanisms of fungi
4.4 Superficial mycoses and dermatophytes
4.5 Subcutaneous mycosis
4.6 Intermediate superficial deep mycosis (cutaneous and systemic)
4.7 Deep or systemic mycoses
4.8 Laboratory diagnosis
4.9 Antifungal agents

C.PUBLIC HEALTH MICROBIOLOGY

5.0 Microbiology of Water and Air
5.1 Bacteriological examination of water
5.2 Tests carried out on water samples
5.3 Methods devised for measuring bacteriological examination of air

6.0 Microbiology of Food
6.1 Factors responsible for food spoilage
6.2 Preventing outbreak of food poisoning
6.3 Epidemiology and control of food poisoning

7.0 Microbiology of Milk and Other Dairy Products
7.1 Significance of bacteriological testing of milk
7.2 Principles of various milk tests
7.3 Statutory tests on milk and dairy products

8.0 Infection Control
8.1 Infection control
8.2 Methods used in infection control

Laboratory work

Refer to current national SOPs

No.	TITLE	RECOMMENDED SOP METHOD
1.	Demonstration of cell cultures	
2.	Demonstration of cytopathic effect	
3.	Demonstration of electron microscopy	
4.	Collection and transportation of viral specimens	
5.	Demonstration of viral investigation on laboratory specimens	
6.	Fungal examination	SOPs Micro
7.	Demonstration bacteriology examination of milk and dairy products	
8.	Bacteriology testing of water samples	SOPs Micro
9.	Bacteriology testing of various food sources to assess and control standard of hygiene	SOPs Micro
10.	Perform Herpes virus detection test	Kit method
11.	Perform viral hepatitis test	Kit method
12.	Perform entero viruses detection test	Kit method
13.	Perform human retrovirus detection test	Kit method

Teaching methods and contact hours:

Lectures 3 hour/Wk
Tutorials 1 hour/Wk
Practicals 3 hour/Wk

Assessment:

Continuous Assessment 40%
- Practical reports 20%
- Tests 15%
- Assignments 5%

Examination 60%
- Written 40%
- Practical 20%

Prescribed text books

Collee, J.G, Fraser, A.G., Marmion, B.P and Simmons, A (1996). Practical Microbiology (14th Edition) Churchill-Livingstone, Edinburgh.

Greenwood, D, Slack and Peutherer, J.F. (2007). Medical Microbiology: A guide to Microbial Infections: Pathogenesis, Immunity, Laboratory Diagnosis and Control (5th Edition) Churchill-Livingstone, Edinburgh

Godkar B.P. and Godkar D.P.,(2007), *Text book of medical laboratory technology,* (2nd edition),Bhalani publishing house, Mumbai.

Recommended text books:

Mims, C.A. and White, D.O. (1984). Viral Pathogenesis and Immunology. Blackwell Scientific, London

Brooks, G. F, Butel, J.S and Ornston, L.N (1991). Medical Microbiology (18th Edition) Appleton & Lange, New Jersey.

Murray R. P.,Baron E.J.,Jorgensen J.H.,Pfaller M.A. and Yolken R.H., (2003),*Manual of clinical microbiology*, (8th edition),American Society for microbiology,Washington.Volumes 1and 2