

Curriculum for Diploma in Medical Laboratory Technology (DMLT)

The State Medical Faculty of Bangladesh

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Preface

With increasing public expectations about the health care services, specially in the emergency & pandemic situation like COVID 19 the quality of care itself is under scrutiny all over the world. Therefore a positive change is needed in the role of Medical Technologists. The role of teachers and students in teaching and learning to bring a positive changes in allied health professionals education also needs to be reviewed and further developed to make it more competency based.

This revised Health Technology (HT) competency based curriculum has been developed and scientifically designed, making it responsive to the needs of the learners and focussed towards the need of consumers and country. The present HT curriculum with its assessment methods is expected to effectively judge competencies acquired with those which are required to cater the health needs of our people. It is gratifying to note that all concerned in the promotion of allied health science in the country have involved themselves in the planning and formulation of this competency based & community oriented need-based curriculum.

Contents like basic computer science, communicative English, Ethics, communication skills, behavioural science, primary health care, environment and sanitation have been given the required emphasis in this document. Though the curriculum is not the sole determinants of the outcome, yet then it is very important as it guides the faculty members in preparing their instruction, tells the students where to go, what to do and what knowledge, skills and attitude they are expected to develop.

In conclusion, I would like to state that, the curriculum planning process should be continuous, dynamic and never-ending. If it is to serve best, the needs of the individual students, educational institutions and the expectations of people community to whom we are ultimately accountable, are required to be evaluated and given due attention.

I congratulate all who were involved in designing and developing the competency based curriculum, particularly the Director, CME, ADGs & Directors of DGME, Secretary, SMFB, members of the working group and the faculty members of Centre for Medical Education (CME). My special thanks to WR, WHO Bangladesh, Team Leader (Health System) & NPO (HRH) WHO Bangladesh for financial & technical support.

Professor Dr A.H. M. Enayet Hussain
Director General
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Foreword

Curriculum planning and designing is not a static process, rather a continuous process done regularly through a system. This curriculum was developed a few years back in 2008 but it was needed to be updated to make it more technology oriented students centred and competency based.

Initially there were policy level meetings and meeting of the Curriculum Working Group of different disciplines/courses from Institute of Health Technologies (IHT) to prepare a draft curriculum. Subsequently, in order to develop a consensus, decision was taken to hold Review Workshops through active participation of different groups of faculty members. A taskforce group examined the revised curriculum for the different courses of IHT to give it a final shape with the financial & technical support by WR, WHO Bangladesh & NPO (HRH) WHO Bangladesh.

The revised Curriculum for Health Technology (HT) is expected to be implemented for the newly admitted students of the next session. The success of this curriculum, which is made more competence based and need-based, depends on its proper implementation with active leadership of the MOH&FW, DGME, SMFB, principals & teachers of IHT with interactive participation of students.

It is expected that this curriculum will serve as present day guideline for the students of IHT and its faculty members. In order to ensure further improvement, this curriculum needs constant review and revision with time to time updating.

My sincere thanks to Prof Dr A.H. M. Enayet Hussain, Director General, DGME, for his guidance & supervision with his team of DGME. My special thanks to Dr. Bardan Jung Rana, WR, WHO Bangladesh, Dr Sangay Wangmo, Team leader (Health System) & Mr Md Nuruzzaman, NPO (HRH), WHO Bangladesh country office for financial & technical support for this activity. I like to thank Professor Dr. Md. Humayun Kabir Talukder, Professor (Curriculum Development & Evaluation), Centre for Medical Education (CME), working co-ordinator, IHT Curriculum Development Committee for his continuous technical assistance and co-ordination to prepare this curriculum. The technical team comprising the faculty members of the Centre for Medical Education (CME) deserve special appreciation.

Lastly, I would like to extend my deep and sincere gratitude to all principals & teachers of different IHTs, subject experts, faculty members and others computer and secretarial support staff of CME who shared their expertise and worked hard to produce this valuable document.

Professor Dr Syeda Shahina Subhan
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Acknowledgement

This is indeed a pleasant responsibility to bring out this curriculum on Diploma in Health Technology course, which has been developed through a participatory approach by a team of policy teachers of IHTs and medical educationists. It aims to review and update the Health Technology (HT) curriculum.

I would like to express my deep gratitude to Prof Dr A.H. M. Enayet Hussain, Director General, DGME, for his overall supervision in this activity along with ADG (Admin), ADG(Education) & Directors of DGME, under the leadership of whom the plan of reviewing and updating the IHT curriculum has been materialized, and who provided immense support and encouragement to finish the work. My cordial thanks are extended to Dr Sangay Wangmo, Team leader (Health System) & Mr Md Nuruzzaman, NPO (HRH), WHO Bangladesh country office for financial & technical support for this activity.

I am grateful to all the resource persons/teachers from different institutes, subject experts, principals of IHT specially the faculty of Center for Medical Education (CME), who devoted their immense efforts, time and hard work to develop this curriculum. My special thanks to Professor Dr. Md. Humayun Kabir Talukder, Professor (Curriculum Development & Evaluation), Centre for Medical Education (CME), working co-ordinator, IHT curriculum reviewing & updating committee for his continuous efforts without which it would not have been possible to complete this work. My thanks to all other faculty members & staffs of CME, who were involved directly or indirectly in preparation of this curriculum.

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Course Overview

Course Aims:

To prepare the 'Medical Laboratory Technologists' with knowledge, skill and attitude to bring about behavioural changes for enabling them to perform assigned responsibilities in their individual working stations.

Course Objectives:

After successful completion of the four (04) Years Diploma course in 'Medical Laboratory Technology' the students will be able to:

- Demonstrate a sound knowledge base in Medical Laboratory Technology discipline.
- Carry out medical laboratory works in different laboratory settings: public & private.
- Organise and maintain a medical diagnostic laboratory.
- Use, operate and maintain equipment, apparatuses, glass wares and reagents of medical laboratory.
- Examine specimens, prepare reports with sign, maintain records & submit periodical reports of a medical laboratory.
- Maintain laboratory safety and undertake measures for prevention of laboratory infections and accidents.
- Manage emergency medical situations arising out of laboratory diagnostic procedures.
- Carry out any assigned role and responsibility of a Medical Laboratory Technologists
- Carry out supervisory role of Medical Laboratory Technologists.
- Participate in health care delivery services in Bangladesh to deal common health problems.
- Demonstrate values and attitudes consistent with ethical and professional conduct.
- Participate continuing education and continuing professional development.
- Contribute to the future development of Medical Laboratory Technologists.

Course Details

A. **Course Title:** Diploma in Medical Laboratory Technology (DMLT).

B. Course philosophy and rationale

- Diploma in Medical Laboratory Technology (DMLT) is a health technological profession whereby the diagnosis of a disease conditions or state of diseases is attempted or performed within the gambit of laboratory facilities.
- Diploma in Medical Laboratory Technology (DMLT) course enables the students to acquire a sound foundation in core skill to perform and carry out the test of the procedures of different methods and techniques for diagnosis of disease.
- This course finds its rationale to develop adequate number of medical technologists in the Medical Laboratory Technology discipline to cope up with growing demand and expansion of health care services in different sectors and to meet the desired need of doctors-paramedics ratio in Bangladesh.

C. Conditions for entrance:

1. Qualifications & prerequisite:

- (i) SSC Science or equivalent with Science with Physics, Chemistry and Biology.
- (ii) Candidate has to secure required grade point in the SSC examinations which will be decided by the concern competent authority.
- (iii) Candidate passed SSC examination in current Year and previous 3rd Year is illegible for admission or as decided by the authority for each year of admission.

D. Examinations for Entrance/Admission Test:

All candidates are to sit for admission tests through prescribed rules and examination method as specified in the advertisement. Selection of the candidates will be done on merit basis as based on marks obtained in the admission test.

Despite the general merit in consideration for selection the reserved quota for different groups of applicants as specified in the advertisement shall be maintained on the merit basis for the respective reserved quota as well. Candidates selected for admission will have to appear before the Medical Boards as organized by the respective Institute of Health/ Medical Technology.

A. Course structure and duration

Total duration of the course will be 4 years

The course will be of four years' duration. The total period is divided into 4 parts-1st year, 2nd year, 3rd year and 4th year. In each there will be 40 weeks of teaching and learning at the end of which there will be a year final examination. Supplementary examinations will be held 6 months of the year final examination.

Year	Duration
1 st Year	12 months
2 nd Year	12 months
3 rd Year	12 months
4 th Year	12 months

NB: All academic activities including yearly faculty examination of each phase must be completed within the specified time of the phase.

NB: Total duration for completion of the four years (4) course will be 10 years after admission in 1st year

E. Distribution of the papers with teaching /learning hour's as per year wise:

1st year

Exams	Papers	Subjects	Lecture (in hours)	Tutorial (in hours)	Institutional Academic Lab based Practical Training/ Demonstration (in hours)	Formative Exam		Summative exam		Total Hours
						Preparatory leave	Exam time	Preparatory leave	Exam time	
Teaching-learning both formative & summative assessment	I	English	66	34	-	7 days	10 days	10 days	15 days	100
	II	Basic Anatomy	70	60	70					200
	III	Basic Physiology	75	60	65					200
	IV	Basic Community Medicine & Behavioral Science	150	50	-					200
	V	Basic computer science	25	-	75					100
		Total	395	195	210	17 days		25 days		800
		Grand total	800 hours			42 days				800 hours

2nd year

Exams	Papers	Subjects	Lecture (in hours)	Institutional Academic Lab based Practical Training/ Demonstration (in hours)	Formative Exam		Summative exam		Total Hours	
					Preparatory leave	Exam time	Preparatory leave	Exam time		
Teaching-learning both formative & summative assessment	I	Physics	40	30	7 days	10days	10 days	15days	70	
	II	Chemistry	80	20					100	
	III	Basic Microbiology & Parasitology	80	20					100	
	IV	Medical Laboratory Science	100	150					250	
	V	Clinical Pathology and Haematology	100	200					300	
		Total	370	450	17 days		25 days		820	
		Grand total	820 hours			42 days				820 hours

3rd year

Exams	Papers	Subjects	Lecture (in hours)	Institutional Academic Lab based Practical Training/ Demonstration (in hours)	Formative Exam		Summative exam		Total Hours
					Preparatory leave	Exam time	Preparatory leave	Exam time	
Teaching-learning both formative & summative assessment	I	Clinical Chemistry	100	150	7 days	10 days	10 days	15 days	250
	II	General Microbiology & Parasitology	100	150					250
	III	Histopathology & Blood Transfusion	100	150					250
		Total	300	450	17 days		25 days		750
		Grand total	750 hours		42 days				750 hours

4th Year

Exams	Papers	Subjects	Lecture (in hours)	Institutional Academic Lab based Practical Training/ Demonstration (in hours)	Special attachment at relevant lab based advance training (in hours)	Formative Exam		Summative exam		Total Hours
						Preparatory leave	Exam time	Preparatory leave	Exam time	
Teaching learning both formative & summative	I	Clinical Biochemistry & Immunology	100	150	150	7 days	10 days	10 days	15 days	400
	II	Special Microbiology	100	150	150					400
		Total	200	300	300	17 days		25 days		800
		Grand total	800 hours			42 days				800 hours

F. Teaching & learning methods, media and faculty members

The following teaching and learning methods will be followed:

1. Large Group Teaching Lecture aided by –
 - Multimedia
 - Computer
 - Chalk board
 - OHP/ Slide projector
 - Handouts
2. Small Group Teaching-
 - Tutorial/ Demonstration
 - Students interaction
3. Practical session-
 - Use of practical manual Chalk board
 - Performing the task/examination by the student
 - Writing the practical note book
 - Log book
4. Lab Placement-
 - In small groups for performing activities by the student themselves as per log book
5. Faculty members-
 - Subject oriented teacher (Professor/ Associate professor/ Assistant professor/Lecturer/Instructor will be illegible to perform lecture/theoretical class.
 - Subject oriented instructors will be illegible to perform practical/demonstration class.

G. Assessment

- Examination will be held on month of January & July of every year.

B. Assessment Methods:

- There will be in-course/formative (card/ item) and end-course/summative (terminal) assessment for the students in each part (1st, 2nd, 3rd & 4th year) of the course i.e. formative and year final examination.
 - There will be year final examination at the end of each academic year and one supplementary examination 6 months after each regular year-final examination.
 - Formative assessment will be done through items and cards ending exam.
- In the year-final examination marks allocation will be as follows:
- 50% from year-final written examination
 - 10% from the formative examinations (Card final examination/Item marks).
 - 40% from the oral and practical examinations.
 - In written assessment Short Answer Question (SAQ) and Multiple choice question (MCQ)-true/false, in practical along with traditional objective structure practical examination (OSPE) & in oral structure oral examination (SOE) will be utilized

Eligibility for appearing in the year-final examination:

- Certificate from the respective head of institutes regarding students obtaining at least 75% attendance in all aspects (theory, practical, tutorial, residential field practice) during one academic year.
- Obtaining at least 50% marks in the formative examinations.

- No objection Certificate from the respective head of institutes regarding taking part any activities contrary to the discipline of the institute.
- No student shall be allowed to appear in the Year II, Year III and Year IV Final examinations unless the student passes all the subjects of 1st, 2nd and 3rd year Final examinations respectively.

Carry on

- One can be eligible to attend the classes of 2nd year after passing at least 3 subjects among 5 subjects of 1st year.
- One can be eligible to attend the classes of 3rd year after passing at least 3 subjects among 5 subjects of 2nd year.
- One can be eligible to attend the classes of 4th year after passing at least 2 subjects among 3 subjects of 3rd year.

C. Assessment personnel:

- Subject oriented teacher (Professor/ Associate professor/ Assistant professor/Lecturer will be illegible to be an examiner, moderator and able to evaluate the examination script.
- Subject oriented instructors will be illegible to undertake the practical examinations

Grading

Numerical percentage of Marks	GPA letter Grade	GPA Numerical Grade (Grade points)
85% and above	A ⁺	4
81% to less than 85%	A	3.75
76% to less than 80%	A ⁻	3.5
71% to less than 75%	B ⁺	3.25
66% to less than 70%	B	3.00
61% to less than 65%	B ⁻	2.75
Only 60%	C	2.50
Less than 60%	F	0

Pass Marks/Grade-C

Written Exam - 60%

Practical - 60%

Oral - 60%

Student shall have to pass written, oral, practical and formative separately in each paper of the examination.

Results will be publish in GPA system and number of the subjects will be reflected in the academic transcript.

H. Examinations & distribution of marks as per each year

1st Year Examination

Paper	Subjects	Written Exam	Oral Exam	Practical Exam	Formative Exam	Total Marks
I	English	75	15	-	10	100
II	Basic Anatomy	100	40	40	20	200
IV	Basic Physiology	100	40	40	20	200
V	Basic Community Medicine & Behavioral Science	100	40	40	20	200
VI	Basic computer science	50	--	40	10	100
	Total	425	135	120	80	800

2nd Year Examination

Paper	Subjects	Written Exam	Oral Exam	Practical Exam	Formative exam	Total Marks
I	Physics	75	10	15	--	100
II	Chemistry	75	10	15	--	100
III	Basic Microbiology & Parasitology	100	40	40	20	200
IV	Medical Laboratory Science	100	40	40	20	200
V	Clinical Pathology an Haematology	100	40	40	20	200
Total		450	140	150	60	800

3rd Year Examination

Paper	Subjects	Written Exam	Oral Exam	Practical Exam	Formative exam	Total Marks
I	Clinical Chemistry	100	40	40	20	200
II	General Microbiology & Parasitology	100	40	40	20	200
III	Histopathology & Blood Transfusion	100	40	40	20	200
Total		300	120	120	60	600

4th Year Examination

Paper	Subjects	Written Exam	Oral Exam	Practical Exam	Formative exam	Total Marks
II	Clinical Biochemistry & Immunology	100	40	40	20	200
II	Special Microbiology	100	40	40	20	200
Total		200	80	80	40	400

I. This curriculum is meant for the guidance of four groups for people --

- Students to guide them in what to learn and how to learn
- Teachers to guide them in what to teach and how to teach
- Examiners to guide them in what to evaluated and how to evaluated
- Concerned policy persons to guide how to implement this curriculum with proper--
 - Governance
 - Guidelines
 - Faculty members with updated organogram
 - Institutional academic lab
 - Attached OPD
 - Special lab attachment as per future job
 - Appropriate students friendly academic environment
 - Teachers to be oriented about the implementation of curriculum
 - Log book to be prepared

J. Required faculty members of the concerned subject/discipline are as follows to implement this curriculum --

- Professor..... 1
- Associate Professor..... 1
- Assistant Professor..... 2
- Lecturer..... 3
- Instructor..... 4
- Technologist..... 5

1st Year

Paper I: Subject - English

Total hours: 100 hour
Lecture: 66 hour
Practical / Tutorial: 34 hours

Total marks-100
Written-75
Oral & practical- 15
Formative 10

Objectives:

At the end of the course the students will be able to: -

- read & write any story in English and attain HSC level English proficiency
- show proficiency in English grammar (article, tense, voice, phrases & idioms)
- write letters in English (private, Official etc).
- translate & retranslate in English
- read and write essays on different topics in English
- develop listening skills in English
- communicate with each other in English
- read and write laboratory reports/findings in English
- follow written and oral instructions in English of the seniors/authorities

List of Competencies

Ability to--

- write Paragraph, Letter, Application & report in English
- show skill in reading, writing ,listening & Conversations in English
- understand & interpret any reports or manuals in English
- read & write any story in English and attain HSC level English proficiency
- write letters in English (private, Official etc.).
- translate & retranslate in English
- read and write essays on different topics in English
- develop listening skills in English
- communicate with each other in English

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Tutorial
1.	<p>Text book: English for Today-Published by N.C.T.B. (Intermediate)</p> <p>Unit- Three: Learning English.</p> <ol style="list-style-type: none"> 1. Learning a language 2. Why to learn English 3. How to learn English 4. Different learners, different ways 5. Dealing with grammar 6. Integrated skills development 7. How to use dictionary <p>Unit-Six: Our Environment.</p> <ol style="list-style-type: none"> 1. The environment and the ecosystem 2. How the environment is polluted. 3. The world is getting warmer. 4. Let's not be cruel to them. 5. Beware of pollution. 6. Forests should stay. 7. How to manage waste. <p>Unit-Twenty-four: People, People Everywhere</p> <ol style="list-style-type: none"> 1. What's the problem? 2. Kalim Majhee's boat. 3. The rootless. 4. Why is there discrimination? 5-7. The Revenge. 	16	

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Tutorial
2.	<p>Grammar:</p> <p>Articles :</p> <ul style="list-style-type: none"> ▪ Indefinite & definite articles <p>Tense:</p> <ul style="list-style-type: none"> ▪ Present, Past & Future tense <p>Voice :</p> <ul style="list-style-type: none"> ▪ Active voice ▪ Passive voice ▪ Voice change <p>Speeches:</p> <ul style="list-style-type: none"> ▪ Direct speeches ▪ Indirect speeches <p>Linkers</p> <ul style="list-style-type: none"> ▪ In addition ▪ Besides ▪ Moreover ▪ However ▪ Because ▪ Either or , neither nor <p>Idioms & Phrases :</p> <p>Subjects & predicate</p> <p>Parts of speech-</p> <ul style="list-style-type: none"> ▪ Noun & its classification ▪ Pronoun & its classification ▪ Adjective & its classification ▪ Verb-Adverb <p>Conjugation</p> <p>Preposition</p> <p>Punctuation (capitalization, fragment, end, comma, semi colon, colon, hyphen, underlining)</p> <p>Spelling</p> <p>Wrong words</p> <p>Translation (Bengali to English, English to Bengali), short story writing, technical description, comprehension.</p>	22	
	<p>Paragraph writing :</p> <p>Letter writing:</p> <p>Application writing:</p> <p>Report writing :</p>	10	
	Telegrams & E-mail:	2	

Course Contents of English (Part -II)**Marks = 25+25**

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Tutorial
	Communicative English : <ul style="list-style-type: none">▪ Reading skill▪ Writing skill▪ Listening skill▪ Conversations skill	4 4 4 4	8 8 8 10
	Total	66	34

Teaching Methods:

Lecture
Practical/ Tutorial/Communication

Media:

Multi media,
Laptop,
OHP,
White Board/marker
Black board/ chalk
Wall chart
VCD, DVD, CD

Assessment:

Written – SAQ -75 marks
Practical - Reading, Listening & conversation & oral -15 marks
Formative -10 marks

Paper II : Subject - Basic Anatomy

Total hours: 200 hours
Lecture: 70 hours
Tutorial : 60 hours
Practical/Demons: 70 hours

Total marks-200
Written-100
Oral-40
Practical- 40
Formative- 20

Objectives:

At the end of the course the students will be able to: -

- acquaint with the anatomical terminologies
- demonstrate a comprehensive knowledge base about the major anatomical organ, system and structure of human body
- identify major anatomical organ, system and structure of human body
- identify the specific structures and organs and application of such knowledge in studying their individual disciplines.
- do surface marking of important organ of human body.

List of Competencies:

Ability to--

- demonstrate a comprehensive knowledge base about the major anatomical organ, system and structure of human body
- identify major anatomical organ, system and structure of human body
- identify the specific structures and organs and application of such knowledge in studying their individual disciplines.
- do surface marking of important organ of human body.

Course Contents of Basic Anatomy

Sl. No	Topics/Lessons	Teaching/learning Hours		
		Lecture	Tutorial	Practical/ Demonstration
1.	Introductory Anatomy : a) Anatomical Terminologies : i) Definition of Anatomy ii) Anterior, Posterior, superior, inferior, medial, lateral & median plane. b) i) Systems of Human body ii) Human cell: structure and classification. iii) Cell division: types. Phases of mitosis iv) Tissue: Types of tissues.	10	05	10
2.	Musculoskeletal system: ▪ component ▪ Types of bones & joints ▪ short description of important bones	10	10	05
3.	Cardio-vascular system. ▪ Location & Basic structure of cardiovascular system ▪ Short description of heart, major arteries, capillaries/veins	10	05	10
4.	Respiratory system ▪ Basic structure of respiratory system ▪ Description of larynx, trachea, bronchi, bronchioles and alveoli ▪ Gross Anatomy of lung	06	06	10

Sl. No	Topics/Lessons	Teaching/learning Hours		
		Lecture	Tutorial	Practical/ Demonstration
5.	Gastro-intestinal and Hepatobiliary system: <ul style="list-style-type: none"> ▪ Short description of the different parts of alimentary system: mouth, tongue, esophagus, stomach, small and large intestine, rectum & anal canal ▪ Anatomy of salivary glands, pancreas, liver, gall bladder 	10	10	10
6.	Genito –urinary system: <ul style="list-style-type: none"> ▪ Anatomy of urinary system ▪ Male genital system: ▪ Female genital system 	10	10	10
7.	Nervous system and Endocrine system. <ul style="list-style-type: none"> ▪ Basic structure of nervous system ▪ Parts of nervous system and short description of brain, spinal cord, cranial nerves, peripheral nerves ▪ Autonomy of nervous system and short description of sense organs-eye, ear, nose, throat, tongue and skin ▪ Important endocrine glands 	12	12	10
8.	Lymphatic System : <ol style="list-style-type: none"> 1. Anatomy of lymph nodes and vessels 	02	02	05
	Total	70	60	70

Teaching Methods:

Lecture
 Tutorial
 Practical/ Demonstration

Media:

Multimedia,
 Laptop,
 OHP,
 White Board/Marker,
 Black/board
 Skeleton
 Wall chart
 Microscope

Assessment:

Written – SAQ= 80 marks, MCQ=20 marks
 Practical or OSPE 40 marks, Oral/SOE-40 marks, formative-20 marks

Paper III : Subject - Basic Physiology

Total hours: 200 hours

Lecture:75 hours

Tutorial: 60

Practical: 65

Total marks-200

Written-100

Oral -40

Practical- 40

Formative- 20

Objectives:

At the end of the course the students will be able to: -

- Demonstrate a comprehensive knowledge on functional aspects of different important components, organs and systems of human body.
- Apply the practical knowledge of human physiology in studying and performing the allotted tasks in their individual discipline.

List of Competencies

- Ability to demonstrate a comprehensive knowledge on functional aspects of different important components, organs and systems of human body.
- Ability to apply the practical knowledge of human physiology in studying and performing the allotted tasks in their individual discipline.

Course Contents of Basic Physiology

Sl. No	Topics/Lessons	Teaching/learning Hours		
		Lecture	Tutorial	Practical/ Demonstration
1.	Introductory Physiology: <ul style="list-style-type: none"> • Physiological terminologies • Basic structure and organizations of human body • Cell physiology and metabolism/multiplication of living cells • General functions of different systems of the body: Musculoskeletal/Respiratory/ Circulatory/Digestive/Urinary/Nervous/ Endocrine/Immune/ Reproductive 	10	04	10
2.	Musculoskeletal system : <ul style="list-style-type: none"> ▪ Physiological components of musculoskeletal system ▪ Functions of important muscles, bones & joints of human body ▪ Movements of joints 	10	10	05
3.	Cardiovascular System: <ul style="list-style-type: none"> ▪ Functions of circulatory system ▪ Composition of Blood and their Functions ▪ Conductive system of heart & Cardiac cycle ▪ Physiology of Blood Pressure 	10	05	10

Sl. No	Topics/Lessons	Teaching/learning Hours		
		Lecture	Tutorial	Practical/ Demonstration
4	Respiratory system : <ul style="list-style-type: none"> ▪ Functions of respiratory system ▪ Mechanism of breathing 	05	05	10
5	Digestive and hepatobiliary system: <ul style="list-style-type: none"> ▪ Definition of digestion, absorption, metabolism ▪ Digestion, absorption & metabolism of carbohydrate, fat & protein ▪ Nutritional deficiency disorders : anemia, iodine deficiency, vitamin deficiencies ▪ Functions of liver, pancreas and gall bladder ▪ Composition & functions of different digestive juices & bile 	10	10	10
6	Genitourinary system: <ul style="list-style-type: none"> ▪ Functions of Kidney ▪ Formation, appearance and composition of urine ▪ Functions of reproductive organs of both sexes: uterus/ovary/fallopian tube/vagina/penis/testes/scrotum/vas deferens/prostate 	10	10	10
7	Nervous system, organs of special sense: <ul style="list-style-type: none"> ▪ Functions of motor, sympathetic & parasympathetic nervous system ▪ Functions of cranial nerves ▪ Cerebrospinal fluid formation, composition & function ▪ Functions of special sense organs-eye, ear, nose, tongue and skin ▪ Functions of the endocrine glands & hormones secreted by them: Pituitary / thyroid / parathyroid / adrenal /gonads/pancreas/placenta 	12	10	10
8	Immune System : <ul style="list-style-type: none"> ▪ Definition/classification and components of immune system ▪ Cells and tissues of immune system & their functions 	05	05	
9	Lymphatic System : <ol style="list-style-type: none"> 2. Structure & functions of lymph nodes and vessels 	03 05	01	
	Total=	75	60	65

Teaching Methods: Lecture, Tutorial, Practical/ Demonstration

Media:

Multimedia, Laptop, OHP, White Board/Marker, Black board/chalk, Wall chart, Lab. Reagent & Apparatus, Microscope

Assessment:

Written – SAQ= 80 marks, MCQ=20 marks

Practical or OSPE 40 marks, Oral/SOE-40 marks, formative-20 marks

Paper IV : Subject – Basic Community Medicine & Behavioural Science

Total hours: 200 hour
Lecture: 150 hour
Practical / Tutorial: 50 hours

Total marks-200
Written-100
Oral-40
Practical- 40
Formative- 20

Objectives

At the end of the course the students will be able to: -

- describe the general aspects of community medicine
- describe the basic concepts of epidemiology
- explain the concept of primary health care
- define organizations of health services and major health program in Bangladesh
- carry on elementary bio-statistics
- describe the concept of Demography and Family Planning
- define Maternal and Child Health (MCH), describe its objectives and explain the importance of ante-natal and post-natal care for mother and children
- define food and nutrition and be aware of nutritional problems in Bangladesh
- acquaint themselves with occupational health hazards and their preventive and protective measures
- describe the principles of health education and their application in the community
- acquaint themselves with environmental pollution and methods of prevention and control of pollution
- explain the basic concept of Essential Service Package (ESP)

List of Competencies:

Ability to --

- describe the general aspects of community medicine
- describe the basic concepts of epidemiology
- explain the concept of primary health care
- define organizations of health services and major health program in Bangladesh
- carry on elementary bio-statistics
- describe the concept of Demography and Family Planning
- define Maternal and Child Health (MCH), describe its objectives and explain the importance of ante-natal and post-natal care for mother and children
- define food and nutrition and be aware of nutritional problems in Bangladesh
- acquaint themselves with occupational health hazards and their preventive and protective measures
- describe the principles of health education and their application in the community
- acquaint themselves with environmental pollution and methods of prevention and control of pollution
- explain the basic concept of Essential Service Package (ESP)

Course Contents of Basic Community Medicine

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical/ Demonstration
1.	Introductory community medicine: <ul style="list-style-type: none"> • Definition of Community Medicine • Concept of health : Definition / Dimensions / Spectrum / Determinants / Indicators • Concept of general principles for prevention and control of communicable and Non-communicable diseases • Concept of health promotion: Definition / Interventions 	16	10
2.	Primary health care: <ul style="list-style-type: none"> ▪ Definition/Elements/ Principles/Scope 	05	02
3.	Health care services and organization: <ul style="list-style-type: none"> ▪ Primary/Secondary/Tertiary Health Care services ▪ WHO/UNDP/UNICEF/CARE/ International Red Crescent / BIRDEM / ICDDR,B 	06	02
4.	Basic Epidemiology: <ul style="list-style-type: none"> ▪ Definition /Aims/Methods/Scope ▪ Definition of epidemiological terms eg. Epidemic/Endemic/Pandemic/Sporadic/ Zoonotic disease/ Incubation period/ period of communicability/ Epidemiological Triad/ Infection/ Contamination/ Infestation etc. ▪ Major health programs in Bangladesh ▪ Medical Information system (MIS) 	12	06
5.	Basic Bio-statistics : <ul style="list-style-type: none"> ▪ Definition /Scope/Functions/Importance and uses of Biostatistics, Medical statistics, Health statistics, Vital statistics ▪ Definition of vital events ▪ Definition/types/characteristics/functions/importance/sources/collection and presentation of data ▪ Morbidity/Mortality/Fertility statistics 	17	04

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical/ Demonstration
6.	Demography and family planning. <ul style="list-style-type: none"> ▪ Demography: Definition/Focus/Process/Stages/Cycle and how to conduct census ▪ Family Planning: Definition/ Objectives/ Scope/Health aspects/Benefits ▪ Contraceptive methods: Short description /Advantages/Disadvantages/Indications/ Contraindications/ Complications 	12	04
7.	Maternal and Child Health Care (MCH): <ul style="list-style-type: none"> ▪ Introduction/Definition/Aims & Objectives / Components of MCH ▪ Maternal health care: Antenatal/Intra natal/Postnatal ▪ Care of the New-born/Under 5 children ▪ Indicators of MCH care: MMR, IMR etc 	10	
8.	Food and nutrition: <ul style="list-style-type: none"> ▪ Food: Definition/Functions/Classification ▪ Sources/types/functions/daily requirements and deficiency of protein, fat, carbohydrate, vitamins and minerals ▪ Definition of nutrition /Balanced Diet ▪ Malnutrition: Definition/Forms/Causes and prevention ▪ Common nutritional problems of Bangladesh: low Birth Weight/Protein Energy Malnutrition/ Nutritional Blindness/ Nutritional Anemia/ Lathyrism 	15	06
9.	Occupational Health : <ul style="list-style-type: none"> ▪ Occupational health : Definition /Objectives ▪ Occupational Hazards: Introduction /Types ▪ Occupational diseases: Definition/Classification/Prevention and control 	08	02
10.	Health education behavioral science and Ethics: <ul style="list-style-type: none"> ▪ Health Education: Definition/Importance / Objectives / Components/ Principles/Methods /Media ▪ Communication Skills: Definition/Key elements /Barriers ▪ Behavioral Science : Introduction & concept ▪ Ethics: Introduction and concept 	12	04

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical/ Demonstration
11.	Environment and sanitation: <ul style="list-style-type: none"> ▪ Definition of environment, pollution, sanitation and environmental sanitation ▪ Water: Safe wholesome water/Source of water/water pollution/Hazards of water pollution /water borne diseases/Hardness of water/Purification of water ▪ Air : Definition/Composition ▪ Air pollution : Sources, pollutants, indicators, health & other effects, prevention & control ▪ Ventilation: Definition/Standards/ Types/ Criteria of good ventilation / effects of good ventilation ▪ Solid waste: Definition/Types/Sources/Health hazards ▪ Disposal of solid waste: Dumping/Controlled tipping or sanitary land fill/ incineration/ composting/Manure pits/Burial ▪ Excreta or night soil: Public health importance/Health hazards/how disease occurs from it/Sanitation Barrier/ Methods of excreta disposal (Unsewered area/Sewered area) 	25	04
12.	First Aid : <ul style="list-style-type: none"> ▪ Definition / Principles of First Aid ▪ First Aid Box-List of contents and their uses ▪ First Aid of : Cuts, bleeding, burn, shock, dog bite, snake bite 	12	06
	Total	150	50

Teaching Methods:

Lecture
Tutorial
Practical/ Demonstration

Media:

Multi media, Laptop, OHP, White Board/Marker,
Black board/chalk
Wall chart
Models & Samples

Assessment:

Written – SAQ= 80 marks, MCQ=20 marks
Practical or OSPE 40 marks, Oral/SOE-40 marks, Formative-20 marks

Paper V : Subject - Basic Computer Science

Total hours: 100 hour

Lecture: 25 hour

Practical / Tutorial: 75hours

Total marks-100

Written-50

Practical- 40

Formative-10

Objectives:

At the end of the course the students will be able to: -

- acquaint with the modern computer technology
- start, Shutdown and restore the windows
- open, close & edit the file
- develop skills in ms word, ms-excel, power point, internet
- create chart, graph , tables etc.
- install different programs & software
- prepare reports of various investigations
- do internet browsing & other applications of internet

List of Competencies

Ability to--

- deal with the modern computer technology
- show skills in ms word, ms-excel, power point
- prepare reports of various investigations
- internet browsing & other applications of internet

Course Contents of Basic Computer Science

Sl No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Tutorial/ Practical
1.	<p>Detailed Contents :</p> <p>Relevant Instruction for Practical :</p> <ul style="list-style-type: none"> ▪ Information Technology -its concept and scope ▪ Computers for information storage, information seeking, information processing and information transmission ▪ Elements of computer system - computer hardware and software: data -numeric data, numeric data; contents of program, processing ▪ Computer organization, block diagram of a computer, CPU, memory ▪ Input devices; keyboard, mouse etc.; output devices; VDU and Printer, scanner, Plotter ▪ Electrical requirements, inter-connections between units, connectors and cables ▪ Secondary storage; magnetic disks-tracks and sectors, optical disk (CD and DVD Memory), primary and secondary memory: RAM, ROM, PROM etc. ▪ Capacity; device controllers, serial port, parallel port system bus 47 ▪ Exercises on file opening and closing; memory management; device management; device management and input-output (I/O) management with respect of windows ▪ Installation concept and precautions to be observed while installing the system and software ▪ Introduction about Operating systems such as and Windows ▪ Special features, various commands of MS word and MS- Excel, Power -point ▪ About the internet-server types, connectivity (TCOP/IP, shell); applications of internet like: e-mail and browsing ▪ Various Browsers like WWW (World wide web); hyperlinks; HTTP (Hyper Text Transfer Protocol); FTP (File Transfer Protocol) ▪ Basic of Networking -LAN, WAN, Topologies 	25	
	<ul style="list-style-type: none"> ▪ Give a PC, name its various components and list their functions ▪ Identification of various parts of a computer and peripherals ▪ Practice in installing a computer system by giving connection and loading the system software and application software ▪ Installation of DOS and simple exercises on TYPE, REN, DEL, CD, MD, COPY, TREE, BACKUP commands ▪ Exercises on entering text and data (Typing Practice) ▪ Installation of Windows 98 or 2000 etc. ▪ Features of windows as an operating system ▪ Start ▪ Shutdown and restore ▪ Creating and operating on the icons ▪ Opening, closing and sizing the windows ▪ Using elementary job commands like-creating, saving, modifying, finding and deleting a file ▪ Creating and operating on a folder ▪ Changing setting like, date, time color (back ground and fore ground) ▪ Using short cuts ▪ Using on line help 		

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Tutorial/ Practical
	<ul style="list-style-type: none"> ▪ MS-WORD ▪ File Management Opening, creating and saving a document, locating files, copying contents in some different file (s), protecting files, Giving password protection for a file ▪ Page set up : Setting margins, tab setting, ruler, indenting ▪ Editing a document : Entering text, Cut, copy, paste using tool-bars ▪ Formatting a document : Using different fonts, changing font size and color, changing the appearance through bold/italic/underlines, highlighting a text, changing case, using subscript and superscript using different underline methods ▪ Aligning of text in document, justification of document, Inserting bullets and numbering : ▪ Formatting paragraph, inserting page breaks and column breaks ▪ Use of headers, footers: Inserting footnote, end note, use of comments ▪ Inserting date, time, special symbols, importing graphic images, drawing tolls ▪ Tables and Borders Creating a table, formatting cells, use of different border styles, shading in tables, merging of cells, partition of cells, inserting and deleting row in a table ▪ Print preview, zoom, page set up, printing options ▪ Using Find, Replace options ▪ Using Tools like: Spell checker, help, use of macros, mail merge, word content and statistics, printing envelops ▪ Using shapes and drawing toolbar ▪ Working with more than one window in MS Word, ▪ How to change the version of the document from one window OS to another ▪ Conversion between different text editors, software and MS word 		30

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Tutorial/ Practical
	<p>MS -Excel :</p> <ul style="list-style-type: none"> ▪ Starting excel, open worksheet, enter, edit, data, formulas to calculate values, format data, create chart, printing chart, save worksheet, switching from another spread sheet ▪ Menu Commands : Create, format charts, organize, manage data, solving problem by analyzing data, exchange with other applications. Programming with MS Excel, getting information while working ▪ Work Books : Managing workbooks (create, open, close, save) working in work books, selecting the cells, choosing commands, data entry techniques, formula creation and links, controlling calculations, working with arrays ▪ Editing a worksheet, copying, moving cells, pasting, inserting, deleting cells, rows, columns, find and replace text, numbers of cells, formatting worksheet : ▪ Creating a chart : Working with chart types, changing data in chart, formatting a chart, use chart to analyze data ▪ Using a list to organize data, sorting and filtering data in list ▪ Retrieve data with MS -Query: Create a pivot table, customizing a pivot table. Statistical analysis of data. ▪ Customize MS-Excel: How to change view of worksheet, outlining a worksheet, customize workspace, using templates to create default workbooks, protecting work ▪ Exchange data with other application: linking and embedding, embedding objects, linking to other applications, import, export document 		20
	<p>Power Point :</p> <ul style="list-style-type: none"> ▪ Making Slide following the rules & principles ▪ Slide Projection 		10
	<p>Internet and its Applications :</p> <ul style="list-style-type: none"> ▪ Log -in to internet ▪ Navigation for information seeking on internet ▪ Browsing and down loading of information from internet ▪ Sending and receiving e-mail ▪ Creating a message ▪ Creating and address book ▪ Attaching a file with e-mail message ▪ Receiving a message ▪ Deleting message 		15
	Total=	25	75

Teaching Methods:

Lecture
Practical

Media:

Computer
Multi media
Computer lab.
Internet connection
White Board
Marker

Assessment:

Written – SAQ- 50 marks
Oral/SOE and Practical – 40 marks
Formative – 10 marks

2nd Year

Paper I : Subject - Physics

Total hours: 70 hour
Lecture : 40hour
Practical/Tutorial: 30 hours

Total marks -100
Written – 75
Oral -10
Practical - 15

Objectives:

At the end of the course, the students will be able to-

- define Physics and state the importance of Physics in the Health Care System.
- describe the different systems of measurement and weights.
- demonstrate basic knowledge on measurement of density and specific gravity of a substance.
- demonstrate basic knowledge on fundamental aspects of heat and temperature, sound, light, electricity and magnetism.

List of Competencies:

Ability to

- define Physics and state the importance of Physics in the Health Care System.
- describe the different systems of measurement and weights.
- demonstrate basic knowledge on measurement of density and specific gravity of a substance.
- demonstrate basic knowledge on fundamental aspects of heat and temperature, sound, light, electricity and magnetism.

Course Contents of Physics

Sl.No	Topic/Lessons তত্ত্বীয়	Teaching/Learning Hours	
		Lecture	Practical
১।	বলবিদ্যা ও পদার্থের ধর্ম : ➤ সরল রেখার গতি, গতির সমীকরণ, নিউটনের গতির সূত্র ত্বরণ ও বল, খাত বল, ভেকটর ও সেলের রাশি। ➤ কৌণিক গতি, কৌণিক বেগ ও ত্বরণ বৃত্তাকার পথে গতি, কেন্দ্রভিগ বল। ➤ কাজ, ক্ষমতা ও শক্তি, শক্তির সংরক্ষণ নীতি। ➤ সরল দোল গতি, সরল দোলক ➤ আর্কিমিডিসের সূত্র ও তার প্রয়োগ আপেক্ষিক গুরুত্ব নির্ণয়।	০৮ ঘন্টা	
২।	তাপ : তাপমিতি, তাপের একক, আপেক্ষিক তাপ, তাপীয় ক্ষমতা পানিসম ও সুপ্ততাপ এবং ইহাদের নির্ণয় পদ্ধতিঃ সরলীয় পদ্ধতিতে তাপের পরিবাহিতা নির্ণয়।	৫ ঘন্টা	
৩।	শব্দ : ➤ শব্দের উৎপত্তি ও শব্দ সালন, আড় তরঙ্গ ও দীঘল তরঙ্গ শব্দের ব্যভিচার ও বীট। বীটের সাহায্যে কম্পন সংখ্যা নির্ণয়। ➤ শব্দের বেগ নির্ণয়। ➤ টানা তারের আড় কম্পন, সূত্রের প্রমাণ।	৫ ঘন্টা	
৪।	আলোক : ➤ গোলীয় পৃষ্ঠে প্রতিফলন। ➤ সমতল ও গোলীয় পৃষ্ঠে প্রতিফলন। সম্পূর্ণ প্রতিফলন, প্রতিসরাংক, প্রিজম প্রতিসারণ। ➤ লেন্সঃ উত্তল ও অবতল লেন্স। লেন্সের শক্তি ও বিবর্ধন লেন্স সংযোজন। ➤ চোখের ত্রুটি সমূহ ও প্রতিকার। ➤ আলোক যন্ত্র-মাইক্রোস্কোপ।	৫ ঘন্টা	

৫।	চুম্বক : ➤ চুম্বকনের বিভিন্ন পদ্ধতিঃ চুম্বকের মতবাদ, চুম্বকের ক্ষেত্র ও প্রবাল্য। বিপরীত বর্গীয় সূত্র প্রাপ্তমুখী ও প্রস্থমুখী অবস্থানে চুম্বকের প্রাবল্য। বিক্ষেপী চুম্বকমান যন্ত্র ও ইহার ব্যবহার। ➤ ভূচুম্বকত্ব।	৪ ঘন্টা	
৬।	তড়িৎ : ➤ স্থির তরিৎ, চার্জের অস্তিত্ব ও প্রকৃতি নির্ণয়। বৈদ্যুতিক আবেশ, কুলম্বের সূত্র, ধারকত্ব, তড়িৎ বিভব। সমান্তরাল পাত ধারক। ➤ বিদ্যুৎ কোষ, তাদের কেন্দ্রে উৎপন্ন চুম্বকক্ষেত্র। বিদ্যুৎ প্রবাহ ও চার্জের একক। ➤ ওহমের সূত্র, বিভব বৈষম্যের একক। রোধ ও আপেক্ষিক রোধ, রোধের একক, রোধ সংযোজন, এমিটার, ভোল্ট মিটার। ➤ বৈদ্যুতিক পরিমাপ, হুইট স্টেম ব্রিজ, মিটার ব্রিজ, পোস্ট অফিস বক্স ও পাটেন শিও মিটার। ➤ তড়িৎ প্রবাহ ও উত্তাপ, জুলের সূত্র, বৈদ্যুতিক পদ্ধতিতে নির্ণয়। ➤ তড়িৎ প্রবাহে রাসায়নিক ক্রিয়া, তড়িৎ বিশেষণ, সূত্র ও ইহাদের প্রমাণ। ➤ তড়িৎ চুম্বকীয় আবেশ।	১৩ ঘন্টা	
	ব্যবহারিক	৪০	

Sl.No	Topic/Lessons	Teaching/Learning Hours	
		Lecture	Practical
৭।	১। শাইড ক্যালিপার্স, স্ক্রুজ ও স্পেরোমিটারের ব্যবহার শিক্ষা। ২। পানি অপেক্ষা হালকা/ভারি তরল ও কঠিন পদার্থের হাইড্রো-স্টেটিক ব্যালেন্স, নিকলসন হাইড্রোমিটার ও আঃ হাইড্রো বোতলের সাহায্যে আপেক্ষিক গুরুত্ব নির্ণয়। ৩। সরল দোলকের সাহায্যে জি এর মান নির্ণয়। ৪। একটি ক্যালরিমিটারের সাহায্যে পানিসম নির্ণয়। ৫। কঠিন ও তরলের আপেক্ষিক তাপ নির্ণয়। ৬। অবতল দর্পনের ফোকাস দূরত্ব নির্ণয়। ৭। প্যারালাক্স পদ্ধতিতে উত্তল লেন্স ফোকাস দূরত্ব নির্ণয়। ৮। একখানা কাচ ফলকের প্রতিসরাংক নির্ণয়। ৯। ওহমের সূত্রের সত্যতা নির্ণয়। ১০। যে কোন দৈর্ঘ্যের তারে আপেক্ষিক রোধ নির্ণয়। ১১। নাল পদ্ধতিতে দুইখানা দৃষ্ট চুম্বকের চৌম্বক ড্রামকের তুলনা।	৩ ঘন্টা	৩ ঘন্টা
	মোট : ৭০ ঘন্টা	৪০	৩০

মান বন্টন : তৃতীয় = ৬০

১। পদার্থের সাধারণ ধর্ম, আলোক ও তড়িৎ প্রতিটি শাখা থেকে ৮ নম্বরের দুটি ও ৪ নম্বরের ২টি করে মোট (৬টি + ৬টি) = ১২টি প্রশ্ন আকারে। তন্মধ্যে ৮ নম্বরের ১টি করে ৩ শাখায় ৩টি ও ৪ নম্বরের ১টি করে ৩ শাখার ৩ টি অর্থাৎ মোট ৬টি প্রশ্নের উত্তর দিতে হবে।

$$8 \times 1 \times 3 = 24$$

$$4 \times 1 \times 3 = 12$$

২। শব্দ ও তাপ ও চুম্বকতত্ত্বঃ প্রতিটি শাখা থেকে ৪ নম্বরের ৪টি করে মোট ১২টি প্রশ্ন থাকবে। সেগুলোর মধ্যে থেকে ২টি করে মোট ৬টি প্রশ্নের উত্তর দিতে হবে।

$$4 \times 2 \times 3 = 24$$

দ্রষ্টব্যঃ বলবিদ্যা ও পদার্থের ধর্ম থেকে ও অন্য যে কোন শাখা থেকে ১টি পরীক্ষণ করতে হবে।

ব্যবহারিকঃ ক্লাস রেকর্ড ৯+১ নং ও ২নং পরীক্ষণ ৮ করে = ১৫ মার্কস

মৌখিক ও ফরমেটিভ = ১০, লিখিত = ৭৫ মার্কস

মোট : তৃতীয়+ব্যবহারিক+মৌখিক = ১০০ মার্কস

Paper II: Subject - Chemistry

Total hours: 100 hour
Lecture : 80 hour
Practical/Tutorial: 20 hours

Total marks -100
Written – 75
Oral - 10
Practical - 15

Objectives:

At the end of the course, the students should be able to:

- describe fundamentals in physical chemistry.
- explain common laboratory process.
- identify organic and inorganic chemical compounds.
- describe the different aspects of metals, non-metal and gaseous substances.

List of Competencies:

Ability to--

- describe fundamentals in physical chemistry.
- explain common laboratory process.
- identify organic and inorganic chemical compounds.
- describe the different aspects of metals, non-metal and gaseous substances.

Course contents of Chemistry

Sl.No	Topic/Lessons	Teaching/Learning Hours	
		Lecture	Practical
	গ্রুপ -ক ভৌত রসায়ন		
১।	ভৌত ও রাসায়নিক পরিবর্তন ও এদের মধ্যে পার্থক্য।	১ ঘন্টা	
২।	পদার্থের গঠনঃ অণু ও পরমাণু-অণুর সংজ্ঞা, আন্তঃআণবিক দূরত্ব, আন্তঃআণবিক, কঠিন, তরল, গ্যাস, পরমাণু, পারমাণবিক ও আনবিক ওজন।	৫ ঘন্টা	
৩।	সাধারণ পরীক্ষাগার প্রণালীঃ দ্রবণ, অভিস্রবণ, পরিস্রাবণ ও অতিপৃক্ত দ্রবণ, দ্রাব্যতা, বাষ্পীভবন, পাতন, আংশিক পাতন, উর্ধ্বপাতন, কেলাসন।	৪ ঘন্টা	
৪।	প্রতীক, সংকেতঃ প্রতীক, আনবিক সংকেত, যোজ্যতা, রেডিক্যাল এবং তাদের যোজনী, যোজনী থেকে আনবিক সংকেত নির্ণয়, গাঠনিক সংকেত।		
৫।	রাসায়নিক বিক্রিয়াঃ বিভিন্ন প্রকারের রাসায়িক ক্রিয়া, রাসায়নিক বিক্রিয়া ঘটানোর উপায় সমূহ।	৪ ঘন্টা	
৬।	অম্ল, ক্ষারক ও লবন।		
৭।	গ্যাসের ধর্ম-বয়েলের সূত্র, চার্লসের সূত্র।	৪ ঘন্টা	
৮।	মৌলের রাসায়নিক তুল্যাংক বা যোজন ভার।	২ ঘন্টা	
৯।	পরমানুর গঠন এবং যোজ্যতার ইলেকট্রনীয় মতবাদ। বিভিন্ন রাসায়নিক বন্ধন।	২ ঘন্টা ২ ঘন্টা	
১০।	ক) এভোগ্যাড্রে সূত্র খ) ভরক্রিয়া সূত্র।		
১১।	রাসায়নিক সংযোগ বিধিঃ ক) ভরের নিত্যতা সূত্র। খ) নির্দিষ্ট অনুপাত সূত্র। গ) শূন্যানুপাত বিধি। ঘ) বিপরীত অনুপাত সূত্র। ঙ) গ্যাস আয়তন সূত্র।	৪ ঘন্টা ২ ঘন্টা ৫ ঘন্টা	
	গ্রুপ -খ অধাতুঃ		

Sl.No	Topic/Lessons	Teaching/Learning Hours	
		Lecture	Practical
১।	নিম্নোক্ত পদার্থ গুলোর উৎস, প্রস্তুতি, ধর্ম এবং ব্যবহারঃ	৭ ঘন্টা	
ক)	অক্সিজেন, ওজোন, পানি ও হাইড্রোজেন পার অক্সাইড।		
খ)	হোলাজেন সমূহঃ ক্লোরিন, রোমিন, আয়োডিন ও হাইড্রো ক্লোরিক এসিড।		
গ)	নাইট্রোজেন, হাইড্রোজেন সালফাইট, সালফার ডাইঅক্সাইড।		
ঘ)	সালফার, হাইড্রোজেন সালফাইট, সালফার ডাইঅক্সাইড, সালফিউরিক এসিড।		
ঙ)	ফসফরাস চ) জারন-বিজারনঃ জারক ও বিজারক পদার্থ		
২।	ধাতুঃ নিম্নোক্ত পদার্থ গুলোর উৎস, প্রস্তুতি, ধর্ম এবং ব্যবহারঃ	৬ ঘন্টা	
ক)	সোডিয়াম-সোডিয়াম হাইড্রোঅক্সাইড, সোডিয়াম কার্বনেট, সোডিয়াম ক্লোরাইড।		
খ)	ক্যালসিয়াম-ক্যালসিয়াম কার্বনেট, ক্যালসিয়াম ফ্লোরাইড, ক্যালসিয়াম সালফেট, বি-চিং পাউডার।	১ ঘন্টা	
৩।	কপার -কপার অক্সাইড, কপার সালফেট, কপার ফ্লোরাইড	১ ঘন্টা	
৪।	জিংক - জিংক অক্সাইড, জিংক ফ্লোরাইড, জিংক সালফেট।		
৫।	এলুমিনিয়াম - এলুমিনিয়াম ফ্লোরাইড, এলুমিনিয়াম সালফেট।	১ ঘন্টা	
৬।	আয়রন - আয়রন সালফেট।	১ ঘন্টা	
৭।	লেড - লেড অক্সাইড।	১ ঘন্টা	
৮।	সিলভার - সিলভার নাইট্রেট।	১ ঘন্টা	
	গ্রুপ - গ জৈব রসায়ন		
১।	জৈব রসায়নের সংজ্ঞা, জৈব ও অজৈব যৌগের মধ্যে পার্থক্য জৈব যৌগের গঠন, শ্রেণী বিভাগ, কার্যকরী বা ত্রিাশীল মূলক।	৪ ঘন্টা	
২।	জৈব যৌগের নিষ্কাশন ও বিশুদ্ধকরণ	১ ঘন্টা	
৩।	সম্পূর্ণ ও অসম্পূর্ণ হাইড্রোকার্বনঃ প্রস্তুত প্রণালী, ধর্ম এবং ব্যবহার -মিথেন, ইথেন, ইথিলিন, এসিটাইলিন।	২ ঘন্টা	
৪।	এলকোহল হ্যালাজেন জাতকঃ মিথাইল ফ্লোরাইড, ক্লোরোফর্ম এর প্রস্তুতি, ধর্ম ও ব্যবহার।	৪ ঘন্টা	
৫।	এলকোহলঃ শ্রেণী বিভাগ, মিথাইল এলকোহল, ইথানল এলকোহল ও গিসারিনের প্রস্তুতি, ধর্ম ও ব্যবহার।	২ ঘন্টা	
৬।	ডাই-ইথাইল ইথারঃ প্রস্তুতি, ধর্ম ও ব্যবহার।	১ ঘন্টা	
৭।	এলডিহাইড ও কিটোল সমূহঃ নিম্নলিখিত যৌগসমূহের প্রস্তুতি, ধর্ম ও ব্যবহার, ফরমালডিহাইড, এসিটালডিহাইড ও এসিটোন।	৩ ঘন্টা	
৮।	কার্বিলিক এসিডঃ এসেটিক এসিড ও সাইট্রিক এসিসেডের প্রস্তুতি, ধর্ম ও ব্যবহার।	৩ ঘন্টা	
৯।	এলকোহল এ্যামাইনঃ এ্যামাইনের শ্রেণী বিভাগ, মিথাইল এ্যামাইন ও ইথাইল এ্যামাইনের প্রস্তুতি, ধর্ম ও ব্যবহার।	২ ঘন্টা	
১০।	এ্যারোমেটিক যৌগঃ নিম্নলিখিত যৌগসমূহের প্রস্তুতি, ধর্ম ও ব্যবহার। বেনজিন, টলুইন, ফ্লোরোবেজিন নাইট্রোবেজিন, অ্যানিলিন, কার্বিলিক এসিড, বেনজালডিহাইড, বেনজোয়িক এসিড ও স্যালিসাইলিক এসিড।	৪ ঘন্টা	
	ব্যবহারিক :		
১।	অম্ল ও ক্ষারের মাত্রা নির্ণয়।		২০ ঘন্টা
২।	হাইড্রোজেন ও অক্সিজেনের প্রস্তুতি।		
৩।	সহজ জৈব ও অজৈব যৌগের আঙ্গিক বিশেষণ।		
	মোটঃ ১০০ ঘন্টা	৮০ ঘন্টা	২০ ঘন্টা

মান বন্টনঃ লিখিত পরীক্ষা=৭৫ মার্কস, ব্যবহারিক = ১৫ মার্কস, মৌখিক/ফরমোটিভ = ১০ মার্কস

গ্রুপ - ক- ২০ নম্বর

গ্রুপ - খ - ২০ নম্বর

গ্রুপ - গ - ২০ নম্বর

গ্রুপ -ক থেকে ৩টি, গ্রুপ -খ থেকে ৩টি এবং গ্রুপ -গ থেকে ৩টি মোট ৯টি প্রশ্ন থাকবে। তন্মধ্যে প্রত্যেক গ্রুপ থেকে অন্ততঃপক্ষে ২ টি করে মোট ৬টি প্রশ্নের উত্তর দিতে হবে।

Paper III: Subject - Basic Microbiology & Parasitology

Total hours: 100-hour
Lecture: 80 hour
Practical: 20 hours

Total marks-200
Written-100
Oral-40
Practical- 40
Formative- 20

Learning objectives:

At the end of the course the students will be able to –

- Define and classify microorganisms, define and explain microbiological terminologies.
- Identify, use and maintain microbiological articles, equipment, apparatus including microscope and mention parts when applicable.
- Clean, wash, decontaminate, disinfect & sterilization microbiological articles, instruments, glass wares etc.
- Define, classify, and mention morphology of bacteria, virus, fungus, parasite and helminth.
- Name medically important bacteria, virus, fungus, parasite, helminth and diseases caused by them.
- Explain anatomy bacteria and bacterial spores: pathogenicity of medically important bacteria, growth & multiplication of bacteria.
- Identify, staining and culture medically important bacteria.
- Mention knowledge about PPE
- Demonstrate basic knowledge of immunity.

List of Competencies:

1. demonstrate basic knowledge on common microbiological and parasitological issues.
2. perform identification of different microorganisms particularly bacteria & fungus of medical importance ensuring laboratory safety using microbiological, reagents, equipment and apparatus.
3. provide best services to the stakeholders using the knowledge and skills.

Course Contents of Basic Microbiology & Parasitology

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture / Tutorial on Theories	Practical/ Demonstration/Field visit
1.	Introduction to microorganisms: <ul style="list-style-type: none"> ▪ Definition and classification of microorganisms ▪ Microbiological terminology ▪ Characteristics of Eukaryotic prokaryotic & sub cellular groups of microorganisms ▪ Microbiological articles, equipment's apparatus ▪ Microscope: Different parts of microscope, & maintenance of microscope 	08	03
2.	Destruction of microorganism: <ul style="list-style-type: none"> ▪ Cleaning, Washing, decontamination disinfection & procedures ▪ Sterilization of different laboratory articles, instruments, glass wares etc. 	07	03

3.	Bacteria: <ul style="list-style-type: none"> ▪ Anatomy of Bacteria, chemical composition of different structures of bacteria ▪ Bacterial Spore: Definition & function spores, Spores bearing bacteria of medical importance ▪ Bacterial toxin: Definition & types of bacterial toxin, characteristics of endotoxin & exotoxin, Toxin producing organism of medical importance, use of bacterial toxins in diseases prevention ▪ Biology of bacteria: Growth & multiplication of bacteria, bacteria growth curve, bacteria growth requirements. Definition & classification of culture media ▪ Classifying bacteria in terms of morphology, staining, spore, flagella, capsule & Pathogenicity. ▪ Staining bacteria: Gram's staining, AFB staining, Albert staining 	15	04
	Virus: <ul style="list-style-type: none"> ▪ General characters of virus ▪ Morphology & classification of virus ▪ List of viruses of medical importance & diseases produced by them 	10	01
	Fungus: <ul style="list-style-type: none"> ▪ General character, Morphology and classification of fungus ▪ List of fungus list medical important and the diseases produced by them 	10	02
	Parasite: <ul style="list-style-type: none"> ▪ Definition /Classification of parasite 	03	01
	Helminth: <ul style="list-style-type: none"> ▪ General characteristics of helminths ▪ Classification /Morphology of helminths 	08	02
	Protozoa: <ul style="list-style-type: none"> ▪ General characteristics of protozoa ▪ Definition /Classification of protozoa 	10	02
	PPE: <i>Personal protective equipment (PPE)</i> for different healthcare activities	04	01
	Immunity: Basic Concept of immunity and immunization Schedule.	05	01
	Total	80	20

Teaching Methods:

- Lecture, Tutorial, Practical/ Demonstration & Field visit

Media:

- Multimedia and Laptop
- OHP and transparencies
- White Board and markers
- Blackboards and chalk
- Online and computer based teaching learning materials
- Laboratory: (Microscope, Autoclave, Hot Air Oven, Incubator, Haemocytometer, Haemoglobin meter, Analytical balance, Centrifuge machine, Rotator, Refrigerator, Photometer, Electrolyte analyzer, Electrophoresis apparatus, ELISA reader, PCR machine, Cell counter etc.)
- Hospital/ Health complex

Assessment:

Written – SAQ= 80 marks, MCQ=20 marks

Practical or OSPE 40 marks, Oral/SOE-40 marks, Formative-20 marks

Paper IV: Subject- Medical Laboratory Science

Total hours: 250 hours
Lecture : 100 hours
Practical : 150 hours

Total marks : 200
Written : 100
Oral : 40
Practical : 40
Formative : 20

Objectives:

At the end of the course the students will be able to –

- Explain the role of laboratory and laboratory workers in health care and training of laboratory personnel.
- Classify and explain the medical laboratory services at different levels of Bangladesh.
- Explain the effective communication and chaining from laboratory services.
- Develop & ensure laboratory safety according to code of safety for medical laboratory.
- Plan, select, collect, order, use, maintain and repair of medical laboratory equipment like plastic wares, equipment of staining of slides, counting WBC, measuring Hb, weighing, water filter and deionisers, centrifuge, incubator and dry block heater, mixers and rotators, pH meters, racks, hot air oven, chemical analyser /photometer, micro pipettes, autoclave, distilled water plant, electrolyte analyser and blood gas analyser, refrigerator, power generator and battery, computer, bottle gas /cylinder gas, microtome, paraffin bath, electrophoresis apparatus, ELISA Reader & washer, PCR machine, auto tissue processor, auto histostainer, floctometer, auto immulyte analyser, automated cell counter, automated ESR analyser & auto mated microbial culture machine
- Keep records and reports to respective authorities.
- Explain the different level of health service structure of Bangladesh

List of Competencies:

- Demonstrate basic knowledge on common issues of medical laboratory.
- Plan, select, collect, order, organise, operate, perform best functions, maintain and repair of medical laboratory equipment.
- Provide best services to the stakeholders using the knowledge and skills.

Course Contents of Laboratory Technique

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical/ Demonstration/ Field visit
1	<p><i>Role of laboratory in the health care and training of laboratory personnel:</i></p> <ul style="list-style-type: none"> ❑ Role of laboratory and its integration into the health service ❑ Training of laboratory workers/Technologists ❑ Professional code of conduct ❑ Upgrading and Continuing Education ❑ Responsibilities of Medical Technologist (Laboratory Medicine) 	05	P-02
2	<p><i>Medical laboratory services at different levels:</i></p> <ul style="list-style-type: none"> ❑ Community based primary health care laboratory at THC/UHC and lower level ❑ District hospital laboratory ❑ Regional hospital laboratory at Medical College Hospitals / Institutes ❑ Central and public health laboratory ❑ Medical laboratories in private and NGO sectors 	05	F-03 (10 hrs)
3	<p><i>Effective communication/ chaining in the laboratory:</i></p> <ul style="list-style-type: none"> ❑ Definition of communication ❑ Three ways of communication – writing, speaking & actions ❑ Guidelines for effective communication in the laboratory 	04	F-01(04 hrs)
4	<p><i>Laboratory policies &:</i></p> <ul style="list-style-type: none"> ❑ Setting up a medical laboratory ❑ Laboratory hours and emergency work ❑ Work load/capacity of the laboratory 	03	F-01(04 hrs)
5	<p><i>Safety in the laboratory:</i></p> <ul style="list-style-type: none"> ❑ Safe laboratory design and organisation ❑ Laboratory hazards, accidents, infection, burn, cuts, harmful effects of the materials, injury from explosion, electric shocks, handling of explosive and poisonous agents. ❑ Preventing laboratory/cross infections ❑ Pipetting and dispensing safety with automation ❑ Safe use of equipment particularly autoclave, hot air oven, incubator, Calorimeter, Spectrophotometer, Analyser etc. 	14	P-10
6.	<p><i>Code of safety for medical laboratory:</i></p> <ul style="list-style-type: none"> ❑ Formulation of a safe laboratory practice ❑ Enforcing code of safe laboratory practice 	02	P-2 F-1(05 hrs)

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical/ Demonstration/ Field visit (each 02 hours)
7	<p><i>Equipment for a medical laboratory:</i></p> <ul style="list-style-type: none"> ❑ Selection, maintenance and ordering of equipments: Criteria of selection, approach new technologies, repair & maintenance of laboratory equipment, ordering of laboratory equipment & supply ❑ Laboratory plastic wares: Illustrated schedule of plaster ware, Cleaning of plastic wares, Availability of plastic wares. ❑ Equipment of staining: Stains dispensing container, staining jar or racks & trough, trough with rods, staining units and slide, drying rack ❑ Equipment for counting WBC: Equipment for diluting and measuring blood, haemocytometer, hand tally meter, differential cell counter. ❑ Equipment for measuring Hb: Visual direct reading system, electronic haemoglobin meters ❑ Equipment for weighing: Manually operated scales and balance, Direct read-out electric balance, use and care of laboratory balance/analytical balance ❑ Stills, water filter and Deionisers: Distillation, Deionisation, water stills, water filters, portable hand deioniser ❑ Centrifuge: Centrifugal force, types of centrifuge roller, choosing a centrifuge, Bench centrifuge, haematocrit centrifuge, use and care of a centrifuge ❑ Incubator and dry block heater: Incubators, (electric models) dry block heaters and water baths ❑ Mixers and rotators: Cell mixers, Vortex mixer, Magnetic stirrers, Rotators ❑ pH meters: Types, care and maintenance of pH meter ❑ Racks: Nylon coated wire racks, plastic racks ❑ Hot air oven, Chemical analyser/Photometer, Micro pipettes, Autoclave, Distilled water plant, Electrolyte analyser and blood gas analyser, Refrigerator, Power generator and battery, Computer, Bottle gas/Cylinder gas, Microtome, paraffin bath, Electrophoresis apparatus, ELISA Reader & washer, PCR machine, Auto Tissue Processor, Auto Histostainer, Flocytometer 	46	P-100
8	<p><i>Records and reports:</i></p> <ul style="list-style-type: none"> ❑ Records and reports ❑ Records for health centres, hospital inpatient and outpatient departments ❑ Records of patients and investigations ❑ Sending specimens to a central or referral laboratory. 	05	P-04

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical/ Demonstration (each 02 hours)
9	<i>Health Service structure in Bangladesh and Patient Care:</i> <ul style="list-style-type: none"> ❑ Structure of health services in Bangladesh ❑ Staffing pattern of Thana Health Complex & UHFWC ❑ Job description of a medical technologist ❑ Store, supply of material & equipment and stock keeping ❑ Advice to the patient before coming for investigation ❑ Personal dealings & hygiene in relation to a patient ❑ Preparation, reception and care of the patients coming for investigations ❑ Need for adoption of proper measures and sterilisation, preventing spread of infection in laboratory ❑ Management of unconscious patient ❑ Nursing care: temperature, pulse, respiration, bed pans, urinals, enemas ❑ Management of bleeding/haemorrhage ❑ Administration of oxygen and use of suction apparatus 	16	P-10
	Total =	100	150

Teaching Methods:

- Lecture
- Tutorial
- Practical/ Demonstration
- Field visit

Media:

- Multimedia and Laptop
- OHP and transparencies
- White Board and markers
- Blackboards and chalk
- Online and computer based teaching learning materials
- Laboratory: (Microscope, Autoclave, Hot Air Oven, Incubator, Haemocytometer, Haemoglobin meter, Analytical balance, Centrifuge machine, Rotator, Refrigerator, Photometer, Electrolyte analyzer, Electrophoresis apparatus, ELISA reader, PCR machine, Cell counter etc.)
- Hospital/ Health complex

Assessment:

Written – SAQ= 80 marks, MCQ=20 marks

Practical or OSPE 40 marks, Oral/SOE-40 marks, Formative-20 marks

Paper V: Subject - Clinical Pathology & Haematology

Total hours : 300 hours
Lecture : 100 hours
Practical : 200 hours

Total marks : 200
Written : 100
Oral : 40
Practical : 40
Formative : 20

1. Clinical Pathology

Objectives:

At the end of the course the students will be able to –

- Define, explain and classify (if applicable) relevant terms in clinical pathology.
- State composition of urine, stool, CSF, semen, sputum & other body fluids & discharge.
- State indications of urine, stool, CSF, semen, sputum & other body fluids & discharge for examination.
- Differentiate different normal and abnormal specimens such as urine, stool, CSF, semen, sputum & other body fluids & discharge for examination in clinical pathology laboratory.
- Collect, preserve and prepare the specimens of urine, stool, CSF, semen, sputum & other body fluids & discharge for diagnostic examination.
- Explain the principles of Physical, Chemical, Microscopical, Bacteriological, and relevant examinations of different specimens and smears of urine, stool, CSF, semen, sputum & other body fluids & discharges.
- Carry out the steps involved in Physical, Chemical, Microscopical, Bacteriological, and relevant examinations of different specimens and smears of urine, stool, CSF, semen, sputum & other body fluids & discharges.
- Ensure laboratory safety including personal and other stakeholders' safety.

List of Competencies:

- Demonstrate basic knowledge on common issues of clinical pathology.
- Set, organise, operate and perform best functions the common clinical pathology tests using human body samples, reagents, instruments and equipment appropriately.
- Provide best services to the stakeholders using the knowledge and skills.

Course Contents of Clinical Pathology

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical / Demonstration / Field visit
1	<i>Introduction to clinical pathology & terminologies</i>	02	-
2	<i>Urine examination</i> <ul style="list-style-type: none"> <input type="checkbox"/> Characteristics and composition of a normal & abnormal specimen of urine <input type="checkbox"/> Reasons for testing urine <input type="checkbox"/> Collection and preservation of urine for: Physical/ Chemical/ Microscopic & microbiological examinations <i>Physical examination:</i> <ul style="list-style-type: none"> <input type="checkbox"/> Amount/ Colour/ Odour <input type="checkbox"/> Transparency and sediments <input type="checkbox"/> Specific Gravity <i>Chemical examination:</i> <ul style="list-style-type: none"> <input type="checkbox"/> Determination of reaction <input type="checkbox"/> Detection of Albumin/ Protein/ Sugar/ Acetone/ Bile salts & pigments/ Bence Jones Protein/ Blood/ Chyle etc <i>Microscopical examinations:</i> <ul style="list-style-type: none"> <input type="checkbox"/> General technique <input type="checkbox"/> Centrifugation of urine <input type="checkbox"/> Preparation of urine slide for microscopic examination- Organised deposits/ Unorganised deposits/ Others <input type="checkbox"/> Use and maintenance of Urinalyzer 	03 01 03 02 06 03 0	- - 08 04 16 06 02
3	<i>Stool examination</i> <p><i>Collection and preservation of faeces:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> For Physical/ Chemical & microscopical examinations <i>Physical examination:</i> <ul style="list-style-type: none"> <input type="checkbox"/> Consistency/Amount/ Colour/ Odour/Mucus/Blood <i>Chemical examination:</i> <ul style="list-style-type: none"> <input type="checkbox"/> Determination of reaction <input type="checkbox"/> Test for Lactose/Reducing substances/ Urobilin / Bilirubin/ fat <input type="checkbox"/> Test for Occult Blood <i>Microscopical examination:</i> <ul style="list-style-type: none"> <input type="checkbox"/> Preparation of slide: stained and unstained <input type="checkbox"/> Saline stool smear/Iodine stool smear <input type="checkbox"/> Formal ether conc. test <input type="checkbox"/> Floation concentration method 	02 01 05 05	04 02 10 10
4	<i>Cerebro Spinal Fluid (CSF):</i> <ul style="list-style-type: none"> <input type="checkbox"/> Source of CSF <input type="checkbox"/> Collection: Lumbar puncture <input type="checkbox"/> Features of Normal CSF: Physical/ Chemical/ Cytological and Bacteriological <input type="checkbox"/> Examination of CSF: Physical/ Chemical/ Cytological examinations 	04	10

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical / Demonstration / Field visit
5	<p>Examination of semen/ seminal fluid:</p> <ul style="list-style-type: none"> ❑ Formation and composition of semen ❑ Method of collection of semen ❑ Procedures of physical, chemical & microscopic examination of semen ❑ Selection of semen on material for medicolegal purposes ❑ Procedure for chemical examination for fructose content ❑ Procedure for Immunological examination for Sperm Agglutination Antibody (SAA) 	04	10
6	<p>Examination of sputum:</p> <ul style="list-style-type: none"> ❑ Formation & composition of sputum ❑ Collection, preservation & transport of sputum for examination ❑ Physical examination of sputum- Colour, consistency & odour ❑ Procedure for microscopic examination of unstained smears of sputum sample ❑ Procedure for microscopic examination of stained smears of sputum such as Leishman staining, Gram's staining, Zeehl Neelsen staining 	04	10
7	<p>Examination of body fluid & discharges:</p> <ul style="list-style-type: none"> ❑ Procedure of collection of body fluids such as pleural fluid, ascitic fluid etc ❑ Procedure for physical, chemical & microscopical examination of body fluids & discharges 	05	08
	Total =	50	100

2. Haematology

Objectives:

At the end of the course the students will be able to –

- Define blood, state function and composition of blood.
- Mention normal values, formation, development, functions and fate of blood cells.
- Mention the characteristics of normal and abnormal blood cells.
- Define and classify anaemia.
- Name the apparatus and methods of cleaning the apparatus used for examination of blood.
- Mention the methods for collecting capillary blood and venous blood using different anticoagulants, separation of serum & plasma.
- Perform haemoglobin estimation by Sahli's method and cyanmethhaemoglobin method, haemoglobin electrophoresis, thin and thick blood films preparation, staining and examination.
- Perform RBC counting. PCV, MCV, MCH, MCHC, TLC, DLC, Reticulocytes count, Thrombocyte count and ESR by manual methods and using automated cell counter.
- Determine Volume Index, Colour Index, Saturation Index, Blood and Plasma volume.
- Perform CT, BT, PT, APTT, Factor assay, Calcium Time, Fibrinogen, D-Dimer test, Clot Retraction Time and Fragility of RBC's
- Perform advanced haematological tests using Flow Cytometry, Coagulometry and Electrophoresis-based methods
- Assist in collecting and preparation of bone marrow for examination
- Identify of Malarial, Filarial and Leishmanin parasites in blood

List of Competencies:

- Demonstrate basic knowledge on common issues of haematology.
- Set, organise, operate and perform best the common haematological tests using human blood, reagents, instruments and equipment appropriately.
- Provide best services to the stakeholders using the knowledge and skills.

Course Contents of Haematology

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical / Demonstration / Field visit
1	Introduction to Haematology: <ul style="list-style-type: none"> ❑ Definition, function and composition of blood ❑ Formation, development, functions and fate of different blood cells ❑ Normal values of blood cells ❑ Normal and abnormal blood cells ❑ Apparatus used for examination of blood ❑ Methods for cleaning apparatus ❑ Methods for collecting capillary blood/ venous blood ❑ Anticoagulants used in the haematological laboratory ❑ Techniques for separation of serum & plasma ❑ Anaemia: Definition and classification 	01 01 01 01 01 01 01 01 01 01	- - - 02 02 04 04 02 02 -
2	Principles and procedures for determining: <ul style="list-style-type: none"> ❑ Haemoglobin estimation by Sahli's Method ❑ Haemoglobin estimation by Cyanmethhaemoglobin method ❑ Method for haemoglobin electrophoresis ❑ Thin and thick blood films preparation, Staining and Examination ❑ Counting Red Blood Cells: Principles, procedures & sources of error 	01 01 02 02 03	02 02 04 04 06
3	Principles and procedures for determining: <ul style="list-style-type: none"> ❑ Packed Cell Volume (PCV) ❑ Mean Corpuscular Volume (MCV) ❑ Mean Corpuscular Haemoglobin (MCH) ❑ Mean Corpuscular Haemoglobin Concentration (MCHC) ❑ Method for counting total leukocytes count ❑ Method for differential count of WBC ❑ Method for measuring erythrocytes: Principle/ Procedure ❑ Method for counting Reticulocytes ❑ Method for counting Thrombocytes ❑ Operational use and maintenance of automated cell counter. 	04 02 02 02 01 02 02	12 04 04 04 02 04 04
4	Methods for determining: <ul style="list-style-type: none"> ❑ Erythrocyte Sedimentation Rate (ESR)-manual & ESR Autoanalyser methods. ❑ Volume Index/ Colour Index/ Saturation Index ❑ Blood and Plasma volume –Principles, procedures & sources of error 	03	06
5	Principles and Procedures for determining coagulability : <ul style="list-style-type: none"> ❑ Coagulation Time (CT) ❑ Bleeding Time (BT) ❑ Prothrombin Time (PT), APTT, Factor assay ❑ Calcium Time, Fibrinogen, D-Dimer test ❑ Clot Retraction Time ❑ Fragility of RBC's 	06	14
	Advanced haematological tests: <ul style="list-style-type: none"> ❑ Flow cytometry ❑ Coagulometry ❑ Electrophoresis-based methods 	04	08

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical / Demonstration / Field visit
6	<i>Principles and technique of</i> □ Assisting in collecting and preparation of bone marrow for examination	01	02
7	<i>Principles and procedures</i> □ Identification of Malarial, Filarial and Leishmanin parasites in blood	02	04
Total =		50	102

Teaching Methods:

- Lecture
- Tutorial
- Practical/ Demonstration
- Field visit

Teaching Learning Media:

- Multimedia and Laptop
- OHP and transparencies
- White Board and markers
- Blackboards and chalk
- Online and computer based teaching learning materials
- Laboratory: (Microscope, Autoclave, Hot Air Oven, Incubator, Haemocytometer, Haemoglobin meter, Analytical balance, Centrifuge machine, Rotator, Refrigerator, Photometer, Electrolyte analyzer, Electrophoresis apparatus, ELISA reader, PCR machine, Cell counter etc.)
- Hospital/ Health complex

Assessment:

Written – SAQ= 80 marks, MCQ=20 marks

Practical or OSPE 40 marks, Oral/SOE-40 marks, Formative-20 marks

3rd Year
Paper I: Subject– Clinical Chemistry

Total hours : 250 hours
Lecture : 100 hours
Practical : 150 hours

Total marks : 200
Written : 100
Oral & Practical : 40+40
Formative : 20

Objectives:

At the end of the course the students will be able to -

- Define acids, bases, solutions, percent solution, molar solution, normal solution, pH of solutions, buffer.
- Classify solution, buffer.
- Explain principles of chemical reactions, acid-base reactions, concentration of solution.
- Prepare solution, molar solution, normal solution, pH of solutions, buffer
- Dilute solutions and body fluids/solutions.
- Use and storage of chemicals & reagents safely.
- Explain principles of tests using Colorimetry and spectrophotometry, Flame Emission spectrometry, Autoanalyser HPLC and ELISA reading.
- Perform tests using Colorimetry and spectrophotometry, Flame Emission spectrometry, Autoanalyser HPLC and ELISA reading.
- Define, explain and use different SI Units and reference range.
- Perform renal function tests and test for metabolic diseases.

List of Competencies:

- Demonstrate basic knowledge on common issues of clinical chemistry.
- Set, organise, operate and perform best functions the common clinical chemistry tests using human body fluids, reagents, instruments and equipment appropriately.
- Provide best services to the stakeholders using the knowledge and skills.

Course Contents of Clinical Chemistry

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical / Demonstration / Field visit
1	<p><i>Introduction to clinical chemistry:</i></p> <ul style="list-style-type: none"> ❑ Principles of chemical reactions ❑ Acids, Bases and Acid-Base reactions ❑ Solutions, Classification, Preparation of solution, percent solution, molar solution, normal solution ❑ pH of solutions, Measurement of pH-by-pH meter ❑ Expressing the concentration of solutions ❑ Buffer: Definition, Classification, Preparation, Uses. ❑ How to dilute solutions and body fluids/solutions ❑ Safe use and storage of chemicals & reagents 	22	34
2	<p><i>Colorimetry and spectrophotometry, Flame Emission spectrometry and Autoanalyser:</i></p> <ul style="list-style-type: none"> ❑ Principles of calorimetric and spectrophotometric tests ❑ Calibration of calorimetric and spectrophotometric tests ❑ Measurement of absorbency using a colorimeter and spectrophotometer, flame photometer ❑ Flame Emission spectrometry: Spectrometer and Flame photometer, electrolyte analyzer ❑ Use of Autoanalyser in clinical chemistry ❑ Use of HPLC 	22	34
3	<p><i>ELISA reading:</i></p> <ul style="list-style-type: none"> ❑ Methods of ELISA reading ❑ Handling of micropipette ❑ Mathematical calculation from reader 	10	12
4	<p><i>SI Units in clinical chemistry:</i></p> <ul style="list-style-type: none"> ❑ Introduction ❑ SI base Units/ SI derived Units/ Named SI derived Units/ SI Units prefixes ❑ Application of SI Units in clinical chemistry ❑ Conversation of unit's gram/mol/mmol/μmol/international unit (IU) 	10	12
5	<p><i>Reference range:</i></p> <ul style="list-style-type: none"> ❑ Factors affecting clinical chemistry test results ❑ Biological and laboratory facts ❑ How reference ranges are established ❑ Assessing reference (Normal) ranges ❑ Interpretation of results outside reference ranges ❑ Chart for reference ranges 	10	14
6	<p><i>Tests for Renal function:</i></p> <ul style="list-style-type: none"> ❑ Measurement of serum or plasma urea and creatinine ❑ Testing urine for protein ❑ Detection of Bence Jones Protein in urine ❑ Urine Relative Mass Density (specific gravity) ❑ Testing urine for haemoglobin ❑ Control and selection of urine reagent strip 	16	26

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical / Demonstration / Field visit
7.	<i>Biochemical tests for metabolic diseases:</i> <ul style="list-style-type: none"> ❑ Measurement of plasma glucose ❑ Glucose Tolerance Test (GTT) ❑ Testing urine for glucose/ Ketone bodies ❑ Measurement of serum total calcium 	10	14
Total =		100	146

Teaching Methods:

- Lecture
- Tutorial
- Practical/ Demonstration
- Field visit

Media:

- Multimedia and Laptop
- OHP and transparencies
- White Board and markers
- Blackboards and chalk
- Online and computer based teaching learning materials
- Laboratory: (Microscope, Autoclave, Hot Air Oven, Incubator, Haemocytometer, Haemoglobin meter, Analytical balance, Centrifuge machine, Rotator, Refrigerator, Photometer, Electrolyte analyzer, Electrophoresis apparatus, ELISA reader, PCR machine, Cell counter etc.)
- Hospital/ Health complex

Assessment:

Written – SAQ= 80 marks, MCQ=20 marks

Practical or OSPE 40 marks, Oral/SOE-40 marks, Formative-20 marks

Paper II: Subject - Microbiology & Parasitology

Total hours: 250 hours
Lecture : 100 hours
Practical: 150 hours

Total marks : 200
Written: 100
Oral & Practical : 80
Formative: 20

1. Microbiology

Objectives:

At the end of the course the students will be able to –

- Mention types and parts, indications and principles of works, procedure of safe use, common problems and care of microscopes.
- Explain the procedures of good laboratory practices, use of microbiology safety cabinets, control of laboratory infections, ensuring personal safety, and WHO safety code of practice for microbiology laboratory.
- Operate, use and maintain important instruments and equipment such as Autoclave, Hot air oven, Incubator, Centrifugal machine, Refrigerator, Petridis, Wire loop, Glassware, Laminar air flow Co₂ Jar.
- Classify microbiological specimens, collect, pack and despatch / transport and preserve specimens
- Define, classify & perform step wise of Gram's staining, Z.N. staining, Albert staining, staining for spore, capsule, flagella
- Define and classify culture and media, prepare medically important medias, sterilize and inoculate of media
- Define and classify immunity, antigens and antibody, explain antigen- antibody reactions.
- Mention immunisation schedule

List of Competencies:

- Demonstrate basic knowledge on common microbiological issues.
- Set, organise, operate and perform functions the common microbiological tests using human body samples, reagents, instruments and equipment appropriately.
- Provide best services to the stakeholders using the knowledge and skills.

Course Contents of Microbiology

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical / Demonstration / Field visit
1.	<i>Microscope and Microscopy:</i> <input type="checkbox"/> Types of microscopes <input type="checkbox"/> Parts of a compound microscope <input type="checkbox"/> How a microscope works and its uses <input type="checkbox"/> Trouble with microscope and its care <input type="checkbox"/> Some Do's and don'ts dos in Microscopy	03	06
2.	<i>Safety in microbiology laboratory</i> <input type="checkbox"/> Good laboratory practices <input type="checkbox"/> Microbiology safety cabinets <input type="checkbox"/> Laboratory infections: Classification and hazards <input type="checkbox"/> Personal safety precaution in microbiology laboratory <input type="checkbox"/> WHO safety code of practice for microbiology laboratory	06	04
3.	<i>Operation, use and maintenance of instruments:</i> <input type="checkbox"/> Operation, use and maintenance of important instruments and equipments such as Autoclave, Hot air oven, Incubator, Centrifugal machine, Refrigerator, Petridish Wireloop, Glassware, Leminar air flow Co ₂ Jar.	10	10
4.	<i>Microbiological specimens:</i> <input type="checkbox"/> Types of specimens <input type="checkbox"/> Collection, packaging and despatch/transport and preservation of specimens	03	06
5.	<i>Bacterial pathogenecity and virulence</i>	03	-
6.	<i>Staining:</i> <input type="checkbox"/> Definition, types & different steps of staining <input type="checkbox"/> Gram's staining/ Z.N. staining/ Albert staining/staining for spore, capsule, flagella	08	13
7.	<i>Bacterial culture and media:</i> <input type="checkbox"/> Definition and classification of culture and media <input type="checkbox"/> Preparation of medically important media <input type="checkbox"/> Sterilisation and inoculation of media	06	12
8.	<i>Immunity:</i> <input type="checkbox"/> Definition and types of immunity <input type="checkbox"/> Antigens and antibody/ Antigen- antibody reactions <input type="checkbox"/> Immunisation schedule	05	F-01
	Total=	41	58

2. Parasitology

Objectives:

At the end of the course the students will be able to –

- Define and classify parasites, mention general aspects of life cycle of parasites.
- Classify helminths; mention morphology and life cycle; perform laboratory diagnosis of AL, AD, TT and EV
- Classify and mention general characteristics of cestodes; state morphology, life cycle and laboratory diagnosis of Taenia Saginata, Taenia Solium, Hymenolepis Nana and Echinococcus Granulosus.
- Classify and mention general characteristics of tremadotes; state morphology, life cycle and laboratory diagnosis of Fasciolopsis Buski, Fsciola Hpatica.
- Classify and mention general characteristics of protozoa; state morphology, life cycle and laboratory diagnosis of Entamoeba Histolytica and E. Coli, Trichomonas Vaginalis
- Classify and mention general characteristics arthropods; mention life cycle and prevention and control of mosquito, housefly, sand fly and lice.
- Classify blood parasites medical importance; mention life cycle and laboratory diagnosis of Plasmodium, Leishmania, & Wuchereria.
- Ensure quality during collection and transport of specimen; use of equipment including microscope, reagents, stains, techniques, detection and recognition of parasites, recording and reporting of results.
- Use techniques to identify parasites from specimens in which parasites are found; direct examination of faecal specimen of ova/larva of helminths such as AL, AD, EV, TT, SS, Taenia, Protozoas; concentration techniques for faecal, counting of helminth eggs.
- Preserve parasites; perform acridine orange technique for chromatoid bodies cyst; perform faecal culture technique to differentiate hookworm species.
- Perform laboratory diagnosis of intestinal and vaginal giardia, intestinalis and vaginal trichomonus.

List of Competencies:

- Demonstrate basic knowledge on common parasitological issues.
- Set, organise, operate and perform best on the common parasitological tests using samples, reagents, instruments and equipment appropriately.
- Provide best services to the stakeholders using the knowledge and skills.

Course Contents of Parasitology

Sl. No	Topics/Lessons	Lecture / Tutorial on Theories	
		Lecture	Practical / Demonstration / Field visit
1	Parasites: <input type="checkbox"/> Definition and classification of parasites <input type="checkbox"/> General aspects of life cycle of parasites	03	-
2	Helminths: <input type="checkbox"/> Classification and morphology <input type="checkbox"/> Life cycle & laboratory diagnosis of AL, AD, TT and EV	06	08
3	Cestodes: <input type="checkbox"/> Classification and general characteristics of cestodes <input type="checkbox"/> Morphology, life cycle and laboratory diagnosis of Taenia Saginata, Taenia Solium, Hymenolepis Nana and Echinococcus Granulosus	06	08
4	Trematodes: <input type="checkbox"/> Classification and general characteristics of trematodes <input type="checkbox"/> Morphology, life cycle and laboratory diagnosis of Fasciolopsis Buski, Fasciola Hepatica	04	04
5	Protozoa: <input type="checkbox"/> Classification and general characteristics of protozoa <input type="checkbox"/> Life cycle and laboratory diagnosis of Entamoeba Histolytica and E. Coli <input type="checkbox"/> Life cycle and laboratory diagnosis of Trichomonas Vaginalis	03	06
6	Arthropods: <input type="checkbox"/> Definition, Classification and general characteristics of arthropods <input type="checkbox"/> Life cycle and prevention/control of mosquito, housefly, sand fly and lice	05	10
7	Blood Parasites: <input type="checkbox"/> Classification, life cycle and laboratory diagnosis of blood parasites of medical importance such as Plasmodium, Leishmania, & Wuchereria	10	20
8	Quality assurance in parasitology: <input type="checkbox"/> Collection and transport of specimen <input type="checkbox"/> Use of equipment including microscope <input type="checkbox"/> Quality reagents and stains <input type="checkbox"/> Performance of techniques <input type="checkbox"/> Detection and recognition of parasites <input type="checkbox"/> Recording and reporting of results	01 04 02 01 02 02	02 08 04 02 04 02

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical / Demonstration / Field visit
9.	<p><i>Techniques used to identify parasites:</i></p> <ul style="list-style-type: none"> ❑ Specimens in which parasites are found ❑ Direct examination of faecal specimen of ova/larva of helminths such as AL/AD/EV/TT/SS/Taenia/Protozoas ❑ Concentration techniques for faecal techniques- Formol Ether /Formol detergent and Flootation Techniques ❑ Counting of helminth eggs ❑ Preservation of parasites ❑ Acridine orange technique for chromatoid bodies cyst ❑ Faecal culture technique to differentiate hookworm species 	01 04 03 01 01 01 02	02 08 06 02 02 02 04
10	<p><i>Laboratory diagnosis of different parasites:</i></p> <ul style="list-style-type: none"> ❑ Intestinal/Vaginal:Giardia Intestinalis/Trichomonus Vaginalis/Trichomonus hominis 	04	08
Total=		66	112

Teaching Methods:

- Lecture
- Tutorial
- Practical/ Demonstration
- Field visit

Teaching Learning Media:

- Multimedia and Laptop
- OHP and transparencies
- White Board and markers
- Blackboards and chalk
- Online and computer based teaching learning materials
- Laboratory: (Microscope, Autoclave, Hot air oven Incubator, laminar flow, Refrigerator etc)
- Hospital/Health complex /EPI

Assessment:

Written – SAQ= 80 marks, MCQ=20 marks

Practical or OSPE 40 marks, Oral/SOE-40 marks, Formative-20 marks

Paper III: Subject – Histopathology & Blood Transfusion

1. Histopathology

Total hours: 250 hours
Lecture: 100 hours
Practical: 150 hours

Total marks: 200
Written : 100
Oral & Practical : 40+40
Formative: 20

Objectives:

At the end of the course the students will be able to –

- Mention the anatomy of normal human cell and tissue and pathological change of tissue in different clinical condition.
- Classify and identify histopathological and cytological specimens.
- Collect, transport, prepare and preserve histopathological and cytological specimens (FNAC, PAP'S, Smear, HVS etc.)
- Perform paraffin fixation, block preparation, section cutting, slide preparation and staining PAP, MGG, H&E, PAS, MPO, AFB and mounting for histopathological and cytological examinations; also immunohistotechniques for slide preparation, staining.
- Perform function, operation and use of histopathological and cytological equipment, apparatus, glass wares like microtomy, paraffin bath, water bath, hot air oven, automatic tissue processor, auto staining machine, cryostat machine, incubator, block capsule, wax, refrigerator, coplin jar, specimen jars, slides, cover slides, mounting gum, diamond pencil(marker), sharpening stone and auto knife sharpener
- Prepare and use histopathological and cytological chemicals and reagents.
- Collect, process and prepare different histopathological and cytological smears such as of body fluids, aspirates and exudates for examination

List of Competencies:

- Demonstrate basic knowledge on common histopathological and cytopathological issues.
- Set, organise, operate and perform best on the histopathological and cytopathological tests using collected human body tissues and cells, reagents, instruments and equipment appropriately.
- Provide best services to the stakeholders using the knowledge and skills.

Course Contents of Histopathology & Cytopathology

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical / Demonstration / Field visit
1	Anatomy of normal human cell and tissue	02	-
2	Pathological change of tissue in different clinical condition	03	-
3	Classification and gross identification of histopathological specimens	04	05
4	Collection, transport, preparation and preservation of histopathological / cytological specimens (FNAC, PAP'S, Smear, HVS etc.)	10	18
5	Principles and methods of paraffin fixation, block preparation, section cutting, slide preparation and stain in, PAP MGG, H&E, PAS, MPO, AFB) and mounting for histopathological examinations Principles, slide preparation, staining procedure of immunohistotechniques.	10	15
		04	08
6	Function, operation and use of histopathological equipment, apparatus, glass wares: <input type="checkbox"/> Microtomy <input type="checkbox"/> Paraffin bath/Water bath/ Hot Air Oven/Automatic tissue processor/Auto Staining Machine, Cryostat Machine <input type="checkbox"/> Incubator/ Block capsule/ Wax/ Refrigerator <input type="checkbox"/> Coplin jar/ Specimen jars/ Slides/ Cover slides <input type="checkbox"/> Mounting gum/ Diamond pencil(marker)/ Sharpening stone/Auto Knife sharpener	13	25
7	Preparation and use of histopathological chemicals and reagents	05	10
8	Collect, process and prepare different cytopathological smears such as of body fluids, aspirates and exudates for examination	10	18
9	Museum Techniques: <input type="checkbox"/> Preservation of museum specimens <input type="checkbox"/> Preparation of mounting solution (Kaicerling I,II,III) <input type="checkbox"/> Care, mounting and displaying of specimens <input type="checkbox"/> Cataloguing of Museum specimens	04	06
	Total=	65	105

2. Blood Transfusion

Objectives:

At the end of the course the students will be able to –

- State principles of blood banking/Transfusion medicine, blood grouping and blood transfusion.
- Mention the blood groups antigen and antibody, anticoagulants used in blood bank, indication and procedures of making blood transfusion safer.
- Perform ABO and Rh blood grouping, cross matching and reverse cross matching, direct and indirect coombs' test, screening tests (HIV, HCV, HBsAg, VDRL, Malaria), acidity test for blood group- antiserum.
- Perform separation of plasma from whole blood, and Blood components separation: PCV/RCC, FFP, Platelet, PRP etc.
- Store and maintain of blood and blood components, use of blood components with their significance.
- Maintenance of blood bank records: Daily register/ Precipitant register/ Rh- negative register/ rare blood group register.

List of Competencies:

- Demonstrate basic knowledge on common issues of blood banking.
- Set, organise, operate and perform best the activities of blood bank using collected human blood and blood products, reagents, instruments and equipment appropriately.
- Provide best services to the stakeholders using the knowledge and skills.

Course Contents of Blood Banking

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical / Demonstration / Field visit
1	<ul style="list-style-type: none"> ❑ Principles of blood banking/Transfusion medicine ❑ Principles of blood transfusion ❑ ABO Blood groups and Rhesus Blood Groups ❑ Method of blood grouping: Washing red cells/ Blood group antigen and antibody, type of antigen-anti body ❑ Cross matching and reverse cross matching ❑ Separation of plasma from whole blood ❑ Anticoagulants used in blood bank ❑ Coombs's test: Direct/ Indirect ❑ Blood transfusion: Indication and procedures/ Making blood transfusion safer ❑ Screening Tests (HIV, HCV, HBsAg, VDRL, Malaria) ❑ Techniques for Blood components separation: PCV/RCC, FFP, Platelet, PRP etc. ❑ Storage and maintenance of blood components ❑ Use of blood components with their significance ❑ Acidity test for blood group- Antiserum ❑ Maintenance of blood bank records: Daily register/ Precipitant register/ Rh- negative register/ Rare blood group register 	35	45
	Total=	35	45

Teaching Methods:

- Lecture
- Tutorial
- Practical/ Demonstration
- Field visit

Teaching Learning Media:

- Multimedia and Laptop
- OHP and transparencies
- White Board and markers
- Blackboards and chalk
- Online and computer based teaching learning materials
- Laboratory: (Microscope, Hot Air Oven, Incubator, centrifuge machine, cell separator machine, Ultra Refrigerated centrifuge machine, Ultra freezer of -50⁰c, Auto tissue processor, auto staining machine, paraffin bath, microtome machine with sharpener)
- Hospital/Health complex.

Assessment:

Written – SAQ= 80 marks, MCQ=20 marks

Practical or OSPE 40 marks, Oral/SOE-40 marks, Formative-20 marks

4th Year

Paper I: Subject - Clinical Biochemistry & Immunology

Total hours : 400 hours
Lecture : 100 hours
Practical : 150 hours
Special Lab Attachment: 150

Total marks : 200
Written : 100
Oral & Practical : 80
Formative : 20

1. Clinical Biochemistry

Objectives:

At the end of the course the students will be able to –

- Explain the principles, procedures and indications of different biochemical tests such as principles, methods, procedures, analysis and recording of results.
- Perform the procedurally different biochemical tests for liver function, for pancreatic enzymes, and GIT diseases, cerebro-spinal fluid, serum cholesterol and lipid profile, electrolytes and cardiac enzyme and chloride in urine.
- Prepare biochemical reagents & chemical, tables and charts for use in the biochemical laboratories.
- Control quality in biochemical laboratories tests and reports.

List of Competencies:

- Demonstrate basic knowledge on advanced issues of clinical chemistry.
- Set, organise, operate and perform best on the activities of advanced clinical chemistry tests using collected human samples, reagents, instruments and equipment appropriately.
- Provide best services to the stakeholders using the knowledge and skills.

Course Contents of Clinical Biochemistry

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical / Demonstration / Field visit
1	Biochemical tests for liver, pancreatic and gastrointestinal tract: <input type="checkbox"/> Investigations for liver diseases (LFT): Measurement of serum or plasma – Total Bilirubin, Total protein, Albumin , Aspartate, Aminotransferase, Alkaline Phosphatase and Urine for bilirubin <input type="checkbox"/> Investigations for pancreatic diseases: Serum or plasma Amylase and Lipase, Faeces for Occult blood test and excess fat, Test for lactose in faeces (for lactose deficiency)	15	13
2.	Biochemical tests for cerebro spinal fluid: <input type="checkbox"/> Measurement of CSF glucose, protein ,& chloride, ADA	03	04
3.	Measurement of Serum Cholesterol: LDL, HDL, Triglyceride, Lipid Profile	05	08
4.	Function and measurement of electrolytes: <input type="checkbox"/> Functions of electrolytes/ Electrolyte and water imbalance <input type="checkbox"/> Conditions of Fluid imbalance <input type="checkbox"/> Electrolytes and Acid Base balance/cardiac enzyme <input type="checkbox"/> Disturbances of Acid-Base balance <input type="checkbox"/> Measurement of sodium , potassium and bicarbonate in serum and plasma, and chloride <input type="checkbox"/> Measurement of Cardiac enzyme <input type="checkbox"/> Serum quantitative estimation of chloride in urine	13	15
5.	Miscellaneous: <input type="checkbox"/> Preparation of reagents for Biochemical tests <input type="checkbox"/> Biochemical tables and charts	05 02	06 02
6.	Quality control in Clinical Chemistry	02	02
	Total =	45	50

2. Immunology

Objectives:

At the end of the course the students will be able to –

- Define and classify immunity, antigen and antibody.
- Explain the factors affecting immunity, harmful effects of immunity, application of serological tests, factors influence the serological tests, DNA Sequencing and Hybridization Techniques
- Explain the principles and methods of Ag test, Ab test, Agglutination test, Precipitation test, Immunofluorescent test, Enzyme Linked Immuno Sorband Assay (ELISA), Complement Fixation Test (CFT), Radio Immuno Assay (RIA) , Chemiluminescence Assay, Nephelometer, Protein Analyzer PCR(RT PCR, Conventional PCR, Realtime PCR), IFAT, Western Blot, Hormone Assay, Hepatic marker, Tumour marker, Drug marker, Fertility marker Testing urine for haemoglobin
- Perform ASO titre, Widal test, VDRL, TPHA, RA test, Rose Waller test, Antinuclear Ab test, Anti CCP, HBsAg (ELISA Method), Thyroid function tests, Assays of FSH, LH, Prolactin, Oestrogen, Progesterone, Testosterone, ACTH, ADH (Aldosterone)

List of Competencies:

- Demonstrate basic knowledge on advanced immunological, serological & hormonal issues.
- Set, organise, operate and perform best the activities of advanced immunological, serological & hormonal tests of collected human samples using reagents, instruments and equipment appropriately.
- Provide best services to the stakeholders using the knowledge and skills.

Course Contents of Immunology

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical / Demonstration / Field visit
1	Principles of immunity: <input type="checkbox"/> Definition and types of immunity <input type="checkbox"/> Short description of different types of immunity <input type="checkbox"/> Factors affecting immunity <input type="checkbox"/> Harmful effects of immunity <input type="checkbox"/> Antigen (Ag) and antibody (Ab) <input type="checkbox"/> Antigen- antibody reaction	05	-
2	Serological diagnosis of microbial diseases: <input type="checkbox"/> Application of serological methods in diagnosing microbial diseases <input type="checkbox"/> Serological techniques: Ag test, Ab test, Agglutination test, Precipitation test, Immunofluorescent test, Enzyme Linked Immuno Sorband Assay (ELISA), Complement Fixation Test (CFT), Radio Immuno Assay (RIA) , Chemiluminescence Assay, Neflometer, Protein Analyzer PCR(RT PCR, Conventional PCR, Realtime PCR), IFAT, Western Blot, Automated dry chemistry <input type="checkbox"/> Factors that influence the use of serological tests <input type="checkbox"/> Principles and methods of following serological tests: RIA, ASO titre, Widal test, VDRL, TPHA, RA test, Rose Waller test, Antinuclear Ab test, Anti CCP, HBsAg (ELISA Method) <input type="checkbox"/> Principles and methods of following special immunological tests: Hepatic marker, Tumour marker, Drug marker, Fertility marker Testing urine for haemoglobin <input type="checkbox"/> DNA Sequencing <input type="checkbox"/> Hybridization Techniques.	02 10 04 08 10 02 02	14 14 08 - -
3	Hormone Assay: <input type="checkbox"/> Principles and methods <input type="checkbox"/> Thyroid function tests <input type="checkbox"/> Assays of FSH, Prolactin, Oestrogen, Progesterone, Testosterone, ACTH, ADH (Aldosterone) Factors that influence the use of serological tests	12	14
	Total=	55	50

Teaching Methods:

- Lecture
- Tutorial
- Practical/ Demonstration
- Field visit

Teaching Learning Media:

- Multimedia and Laptop
- OHP and transparencies
- White Board and markers
- Blackboards and chalk
- Online and computer based teaching learning materials
- Laboratory: (Colorimeter, spectrophotometer, Micropipette, Auto analyzer, ELISA Reader
Flame photometer, Electrolyte analyzer)
- Hospital/Health complex.

Assessment:

Written – SAQ= 80 marks, MCQ=20 marks

Practical or OSPE 40 marks, Oral/SOE-40 marks, Formative-20 marks

Paper II: Subject - Special Microbiology

Total hours : 400 hours
Lecture : 100 hours
Practical : 100 hours
Special Lab Attachment: 200

Total marks : 200
Written : 100
Oral & Practical : 80
Formative : 20

Objectives:

At the end of the course the students will be able to –

- Explain morphology, classification, characteristics, pathogenicity, antigenicity and immunity of common group of medically important bacteria and virus.
- Collect human body sample, prepare and perform unstained and different stained microscopical examination of bacteriological specimen.
- Prepare different media for culture of bacteria, perform inoculation of bacteria in the medias, incubate the media, isolate and identify the bacteria, perform sensitivity / susceptibility tests.
- Perform different biochemical tests for identification of bacteria.
- Assure quality of culture media, staining materials, other reagents, equipment, result, report and records.
- Collect, prepare and perform laboratory diagnosis of fungus of medical importance.

List of Competencies:

- Demonstrate basic knowledge on advanced microbiological issues.
- Set, organise, operate and perform best of the advanced microbiological tests on collected human samples using reagents, instruments and equipment appropriately.
- Provide best services to the stakeholders using the knowledge and skills.

Course Contents of Special Microbiology

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical / Demonstration / Field visit
1	<p>Special Bacteriology:</p> <ul style="list-style-type: none"> □ Morphology, classification, staining reaction, cultural characteristics, biochemical reactions, pathogenicity and antigenicity of the following group of bacteria: Gram positive and negative cocci and bacilli- Staphylococcus, Streptococcus, Pneumococcus, Gonococcus, Meningococcus Mycobacterium, Corynebacterium, Salmonella, Shigella, Escherecis, Proteus, Klebsiella, Vibrio, Clostridium, Spirochaetes, Pseudomonas 	15	30
2	<p>Virology:</p> <ul style="list-style-type: none"> □ Morphology, composition, classification, characteristics, and transmission of the medically important virus: □ Viral infection, pathogenicity and immunity □ Collection and transportation of virus specimen □ Laboratory diagnosis of virus 	05	10
3	<p>Microscopical examination of bacteriological specimen:</p> <ul style="list-style-type: none"> □ Unstained preparation- wet film saline preparation, hanging drop. □ Stained preparation – Gram stainig, AFB, Albert, Giemsa’s, Loeffler’s Methylene Blue and Hiss staining methods 	10	20
4	<p>Culture of micro organism:</p> <ul style="list-style-type: none"> □ Classification of Media □ Preparation of important media – Nutrient broth, Nutrient agar, Blood agar, Chocolate agar, Mckonkey’s agar, Loeffler’s serum slope, Robertson’s cooked meat media, Loenstein’s Jensen media and Monsur’s media etc. 	10	20
5	<p>Inoculation and incubation of culture media:</p> <ul style="list-style-type: none"> □ Study of colonies, □ Isolation and identification of bacteria □ Culture of: Throat swab, urine, stool, blood, pus, sputum, & vaginal and rectal swab, body fluids □ Automated microbial culture 	10	20
6	<p>Quality assurance in culturing micro organism:</p> <ul style="list-style-type: none"> □ Areas requiring quality control □ Control of specimens collection and transport □ Control of microbiological techniques □ Control of culture media □ Control of stains and reagents □ Control of equipment □ Control of reporting and recording results 	08	16

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Lecture	Practical / Demonstration / Field visit
7	<i>Antimicrobial Sensitivity/ Susceptibility testing:</i> <input type="checkbox"/> Antimicrobial drugs/Resistance of bacteria to antimicrobials <input type="checkbox"/> Sensitivity/ <i>Susceptibility</i> testing techniques <input type="checkbox"/> Antimicrobial drug assays <input type="checkbox"/> Limitations of antimicrobial sensitivity tests <input type="checkbox"/> Stokes disc diffusion sensitivity testing technique <input type="checkbox"/> Indirect and direct sensitivity testing <input type="checkbox"/> Suggested antimicrobial contents of discs	10	20
8	<i>Biochemical testing of micro organisms:</i> <input type="checkbox"/> Biochemical tests used to different bacteria: Bile solubility test, Arysulphotose test, Catalase test, Coagulase test, Citrate utilisation test, Deoxy ribonuclease (DNA ase) test, Hydrogen sulphide production test, Insole test, Litmus milk decolourisation test, Nitrate reduction test, Oxidise test (Cytochrome oxidase), Oxidation-fermentation teas (O-F), Twin 80 hydrolysis test, Urease test, Voges-Proskaur (V-P) test and Methylene red test	20	40
9	<i>Procedure for laboratory diagnosis of fungus of medical importance fungus:-Fresh examination of specimen for dermatophytes</i>	02	04
Total=		90	180

Teaching Methods:

- Lecture
- Tutorial
- Practical/ Demonstration
- Field visit

Teaching Learning Media:

- Multimedia and Laptop
- OHP and transparencies
- White Board and markers
- Blackboards and chalk
- Online and computer based teaching learning materials
- Laboratory: (Colorimeter, spectrophotometer, Micropipette, Auto analyzer, ELISA Reader Flame photometer, Electrolyte analyzer)
- Hospital/Health complex.

Assessment:

Written – SAQ= 80 marks, MCQ=20 marks

Practical or OSPE 40 marks, Oral/SOE-40 marks, Formative-20 marks

Special Lab Attachment

Outline of Institutional Academic Laboratory

The institute should be equipped with the standard and instruments that are necessary to develop the skills required for the students to understand equipment and instruments name, name of parts, operational use and maintenance. They should perform various common essential medical laboratory tests and interpret the results.

The following equipment and instruments will be there:

Sl. No	Name of Equipment and instruments
01	Binocular compound microscope
02	Photoelectric colorimeter
03	Semi auto analyzer
04	pH meter
05	Autoclave
06	Hot air oven
07	Incubator
08	Water bath
09	Centrifuge machine
10	Shali's Haemoglobinometer
11	Haemocytometer
12	Chemical balance / Digital weighing machine
13	Vortex mixer
14.	Micropipette (different volume/ range)
15	Urinometer
16.	Westergren ESR Stand
17.	CO ₂ jar
18.	Laminar air flow
19.	Lab Rotator
20	Test tube rack
21	Test tube Holder
22	Spirit lamp
23	Automated blood cells counter
24	ELISA (Reader, washer, incubator)
25	D/W plant
26	Variable volume of glass wares such as measuring cylinder, reagent bottles, beaker, conical flask, volumetric flask, Westergren ESR tube, test tube, centrifuge tube, coplin jar etc.
27	Different chemicals and reagents (Biochemical, serological, pathological, haematological, microbiological, immunological etc.)
28	Different chart (Microbial, Blood cells-normal and abnormal, parasites.
29	Different model
30	Different specimen collecting components (Blood, Urine, Stool, body fluids, Swab, bacterial, viral, parasites, fungal etc..)

Outline of Special Laboratory Attachment

Practical field placements are a great opportunity for the students to begin to gain hands-on experience and build a network of industry contacts. This will ensure that students can secure employment and perform their job responsibilities after successful completion of the course.

Students will work with special equipment's and alongside experienced medical laboratory personnel and this will exceptionally be learning and networking opportunities.

Institutional academic laboratory equipment and instruments with the special following equipment and instruments will be there:

Sl. No	Name of Equipment and instruments
01	Automated biochemistry analyzer
02	Automated immunochemistry analyzer
03	Automated cell counter
04	Automated ESR analyzer
05	Microtome machine
06	Automated tissue processor
07	Flo cytometer
08	Dark field microscope
09	Electron microscope
10	Refrigerated centrifuge machine
11	Automated microbial culture machine
12	Auto histostainer
13	Blood gas analyzer
14	Coagulometer
15	Nephelometer
16	Blood bank refrigerator
17	Platelet agitator
18	Cryobath
19	Cryostat machine
20	Bone marrow collecting needle
21	FNAC collecting components
22	Gross station
23	PCR machine (Real Time, Conventional, Gene expert).
24	Biosafety cabinet

Job description of Medical Laboratory Technologists

General Job

1. Laboratory safety:
 - a) Safety of the laboratory staff:
 - Technologists and other laboratory staff should be properly immunised.
 - Wears proper and protective dress and maintain personal protection.
 - Properly collect and label the high-risk specimens and samples.
 - b) Safety of the patient
 - Maintain safety measures in every individual procedure.
 - Keep arrangements of First Aid for emergency situations and complications.
 - c) Safety of equipments and instruments
 - Ensure cleanliness and maintains the laboratory room, equipment, apparatus and glasswares according to manuals and instructions by subordinate staff.
 - d) Arrangements and security of the laboratory
 - Ensures proper setting up of furnitures, equipment and instruments
 - Supervise and maintain the laboratory rooms.
 - Appropriate security measures to be ensured by laboratory staff.
2. Commitment to the patient
 - a) Should be well behaved to the patients and attendants.
 - b) Explains procedures and consequences to the patients and their attendants.
 - c) Motivate and counsel the patients and attendants where needed.
 - d) Takes consent of the patients and attendants where needed.
3. Handling of poisonous and infected materials.
 - a) Proper labelling and storage of infected and poisonous materials.
 - b) Proper handling of the reagents and chemicals as per instructions.
4. Continues updating and innovation of laboratory facilities.
5. Responsible for inter-departmental co-ordination and co-operation.
6. Arranges safe disposal of used and infected materials.
7. Responsible for quality control in all aspects of laboratory activities.
8. Preparing indents, collection of logistics, maintenance of ledger/register, reporting.
9. Supervision and training of junior colleagues.

Specific Jobs

- I. Job description at **Primary Health Care level**
- II. Job description at **Secondary Health Care level.**
- III. Job description at **Tertiary Health Care level.**
- IV. Job description at **Teaching Institutes.**

Primary Health Care level

1. Perform procedures, methods and examinations of different investigations of clinical pathology (Stool, Urine, Body fluids, Sputum and skin scraping for superficial fungal infection), Haematology (TC, DC, Hb%, ESR, Platelet count, BT, CT, Blood grouping, Rh- typing, PBF study, MP) and semen analysis.
2. Perform procedures, methods and examinations of different investigations on Biochemistry, and Serology and Immunological tests such as Blood Glucose, Urea, Serum Creatinine, Bilirubin ,ALT, AST, Alkaline Phosphatase, Lipid Profile, Total Protein, Albumin, ASO Titre, RA test, CRP test, Widal Test, VDRL/RPR test, Pregnancy test, HbsAg test and other tests as feasible at the THC/UHC level.
3. Perform procedures, methods and examinations of various specimens for gram staining, AFB staining, Giemsa staining, Leishman stain and Albert staining.
4. Perform Active Case Detection (ACD) and Passive Case Detection (PCD) related procedures, methods and examination of blood samples for malaria, filariasis and leishmaniasis.
5. Prepare reagents required for laboratory investigations at the THC/UHC level.
6. Maintain patient's registers, records and prepare and sign the reports and results of the tests.
7. Perform transportation of samples and specimens, with proper labelling and cautions to the referral centres.
8. Ensures self-quality control at different stages of laboratory activities and perform other tasks as assigned.
9. Technologists are accountable to supervising Medical Officer/ Residential Medical Officer/ Junior Consultant in charge of the laboratory.

Secondary Health Care level

They will perform procedures, methods and examination of wide range of laboratory tests in addition to all tests at *Primary Health Care level*.

The additional tests are:

1. Perform procedures, methods and examination for different investigations of clinical pathology such as Sputum, Vaginal swab, Urethral smear and Prostatic smear.
2. Perform procedures, methods and examination for haematological examinations such as Reticulocyte count, Platelet count, Circulating Eosinophil count, Blood parasites and other tests that are feasible.
3. Perform procedures, methods and examination for biochemical, and serological and immunological investigations such as LFT's, RFT's, Lipid profile, Serum calcium, Uric acid, and if possible Serum Electrolytes, and also TPHA, Rose Waller test, Aldehyde test & DAT for Kala-azar , Weil-Felix test, Anti HCV, HIV antibody tests and other tests that are feasible.
4. Perform procedures, methods and examination for bacteriological examination such as preparation of culture media, Culture and sensitivity tests of urine, stool, body fluid and swab.
5. Ensures transportation of samples and specimens, with proper labelling and care to referral centres.
6. Ensures quality control at different stages of laboratory activities and perform other tasks as assigned.
7. Technologists are accountable and referable to clinical pathologist or junior consultant (Pathology) for authenticity, quality control and for responsibility and perform tasks as assigned.

Tertiary Health Care level

They will perform procedures, methods and examination of wide range of laboratory tests in addition to all tests at *Secondary Health Care levels*.

The additional tests are:

1. Haematology :
 - Bone Marrow study and Hb electrophoresis
 - Absolute values - PCV, MCV, MCH, MCHC
 - Special staining – MPO, PAS, LAP, Sudan black stain, Peroxidase stain
 - Other Tests: LE cell, D- Dimer, Fibrinogen, PT, TT, APTT, FCFT, Factor Assay (Factor I - XII), Sickling test, Sea test etc.
 - Floctometry
 2. Clinical Pathology :
 - Urobilinogen, Bile salt, Bile pigment, Detection of Ketone bodies and all cytological staining procedures and examinations
 3. Clinical chemistry:
 - Blood gas analysis, Serum Iron, TIBC, Serum Ferritin, Protein electrophoresis, LDH, CPK, CKMP, ALK Phosphatase, Acid Phosphatase, Creatinine, Lithium, Hb A₁ etc.
 4. Histopathology & Cytopathology:
 - Collection, preservation, storage of specimen, preparation, staining and mounting slides for histopathological and cytopathological examination
 - Immunohistochemistry: ER, PR, HER2, CK, LCA, KI67, CD3, CD45, CD20, CD30, CD117, P53, P83, s100 etc.
 5. Microbiology, Serology and Immunology:
 - Culture, sub-culture, Sensitivity tests
 - Antigen and antibody tests
 - Biochemical tests for the identification of micro-organisms
 - Immune and Auto-immune assays – Immunoglobulins, Plasma proteins, Hepatitis profile, HIV, Herpes Simplex virus (I and II), Cytomegalo virus, Complements (C₃, C₄)
 - Chemiluminescence assay Tests
 - Other tests: Hormone assay, Haemolysin test, Cancer markers, Fungus and Tissue Cultures and PCR(RT-PCR, Conventional, PCR, Real Time PCR)
 - Gene Expert
 - DNA sequencing
 - Hybridization Techniques
 - Western blot etc.
 6. Transfusion Medicine (Blood Bank):
 - Antibody identification & Antibody titre
 - Preparation of Platelet concentrate, RCC, Fresh frozen plasma and AHG cryoprecipitate
 - Wash RBC and Rh genotype/phenotype
 - Cold agglutinin test, Haemolysin test, HLA typing, Tissue matching
 7. Operate and use available automated and latest instruments for laboratory examinations
 8. Maintain quality control of all clinical and research (study) work in the laboratory
- *In special case, if necessary they will perform***
9. Analysis and research of diet and all kinds of food stuff
 10. Analysis and also prepare weaning/supplementary food for children, provide nutrition education and develop nutrition education materials

11. Analysis of the purity/impurities of different types of food stuff and water
12. Iodine estimation of food, water, salt and also Arsenic estimation of water
13. Research and different type of chemical and microbiological test of food and water
14. Production of vaccines i.e. DPT, TT, ARV, IV fluid, Blood bag and different types of pathological, Biochemical, serological and microbiological reagents

At the Teaching Institutes:

At the teaching Institutes the Medical Laboratory Technologists personnel are positioned at three levels:

- a. Lecturer
- b. Instructor
- c. Technologist

a. Lecturers:

- They shall perform tutorial, demonstration, and lecture classes.
- Facilitate practical demonstration and work of the students in the laboratory as a 'facilitator' of practical 'teaching group'
- They will perform large group teaching and supervise the junior colleagues.

b. Instructors:

- They will perform tutorial and demonstration classes relevant to practical items.
- Ensure and guide the students to prepare practical note books.
- Demonstrate elaborately procedures, methods and examinations of the practical works in the laboratory and follow students' performance in the practical classes.
- Supervise practical classes as a 'Team leader'.

c. Technologists:

- They shall run the procedures and examinations in all practical classes.
- Run practical demonstration and works for the students.
- Perform small group demonstration relevant to practical.
- Prepare chemicals and reagents and maintain instruments, apparatus, glasswares and other laboratory material and logistics.
- Responsible for laboratory set up and organisation including maintenance of registers, records and stock ledger under guidance of the supervisors.
- Responsible for the security and safety of the laboratory especially in respect to chemicals and reagents, infection, fire, electric hazards and disposal of wastes.

Bibliography :

- All India Institute of Medical Technologists , Recognised by West Bengal State Council of Technical Education, CD -84, SALT LAKE CITY, CALCUTTA, INDIA
- Diploma Medical Lab. Technology Curriculum, Nepal
- MAHSA College Malaysian, Allied Health Sciences Academy, Malaysia.
- Diploma in Biomedical Science (DBS) Singapore Polytechnic, Singapore.
- Nilai International University College, Indonesia.
- Diploma in Medical Technology of Laboratory Medicine Course Curriculum for 2004 (Draft)
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