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Foreword

With increasing public expectations about the health care services, 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 in positive changes in paramedics and auxiliaries education also needs to be reviewed and further developed.

This revised Health Technology (HT) curriculum has been developed and scientifically designed, making it responsive to the needs of the learners and focussed towards the need of consumers. The present HT curriculum with its assessment methods is expected to effectively judge competencies acquired with those required to cater the health needs of our people. It is gratifying to note that all concerned in the promotion of paramedic health science in the country have involved themselves in the planning and formulation of this need-based HT 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 determinant of the outcome, yet it is very important as it guides the faculty 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 client 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 curriculum, particularly the Director, Medical Education & HMPD, DGHS, Director, CME, Secretary, SMFB, members of the working group and the faculty members of Centre for Medical Education (CME). I offer my special thanks to RTM International and Swisscontact-KATALYST for their technical and financial support.

Professor M A Faiz
Director General of Health Services
DGHS, Mohakhali, Dhaka-1212

Message

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

Initially there were four meetings of the **Curriculum Working Group** of different disciplines 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 support by RTM International & Swisscontact-KATALYST.

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 teachers and 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 Dr. Mainuddin Ahmed Chowdhury, Director, Centre for Medical Education (CME) for his supports. The technical team of the Centre for Medical Education (CME) deserves special appreciation.

I like to thank Dr. Md. Humayun Kabir Talukder, Associate Professor, CME, Co-ordinator of Working Group, Member Secretary, HT Curriculum Development Committee for his continuous technical assistance and co-ordination to prepare this curriculum. My special thanks to RTM International and Swisscontact-KATALYST for their technical and financial support.

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

Prof. Dr. Khondhaker Md. Shefyetullah
Director, Medical Education & HMPD
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Acknowledgement

This is indeed a pleasant responsibility to bring out this curriculum on Health Technology course, which has been developed through a participatory approach by a team of 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. M A Faiz, Director General of Health Services, Prof. Dr. Khondhaker Md. Shefyetullah, Director of Medical Education and HMPD, DGHS, under the leadership of whom the plan of reviewing and updating the HT curriculum has been materialized, and who provided immense support and encouragement to finish the work.

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My thanks to all others of CME, who were involved directly or indirectly in the preparation of this curriculum.

Dr. Md. Abdul Jabbar Mollick
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Course Overview

Course Aims:

To prepare 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 3 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 and glasswares 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 the role and responsibility of a Medical Laboratory Technologists
- Carry out supervisory role of Medical Laboratory Technologists.
- Deal with common health problems and health care delivery services in Bangladesh.
- Demonstrate values and attitudes consistent with ethical and professional conduct.
- Contribute to the future development of Medical Laboratory Technologists.

Job description of Medical Laboratory Technologists

A. General Job

1. Laboratory safety:
   a) Safety of the laboratory staff
      Technologists and other lab. Staff should be properly immunised.
      Wears proper and protective dress and remain alert about 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) Motivation and counselling where and 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 and reporting.

9. Supervision and training of junior colleagues.

B. 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.***

I. Primary Health Care level

1. Perform procedures, methods and examinations of different investigations of clinical pathology (Stool, Urine, Body fluids, and skin scraping), Haematology (TC, DC, Hb%, ESR, BT, CT, Blood grouping, Rh- typing, PBF study) and semen analysis.

2. Perform procedures, methods and examinations of different investigations on Biochemistry and Serology such as Blood Glucose, Urea, Bilirubin, Total Protein, Albumin, ASO Titre, RA test, Widal Test, VDRL test, Pregnancy test, HbsAg test and other tests as feasible at the THC level.

3. Perform procedures, methods and examinations of various specimens for gram staining, AFB staining, Giemsa staining 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 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 caution, to 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 in charge of the laboratory.

II. *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 investigations such as LFT's, Lipid profile, Serum calcium, Uric acid and if possible Serum Electrolytes and also TPHA, Rose Waller test, Aldehyde test & DAT for Kala-azar and Weil-Felix test.

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. Technologists are accountable and referable to clinical pathologist or junior consultant (Pathology) for authenticity, quality control and for responsibility and perform tasks as assigned.

III. ***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.

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 A_1 etc.

4. Histopathology:

- Collection, preservation, storage of specimen, preparation, staining and mounting slides for histopathological examination.

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 (C_3, C_4)
- Other tests: Hormone assay, Haemolysin test, Cancer markers, Fungus and Tissue Cultures and PCR.

6. Transfusion Medicine (Blood Bank):

- Antibody identification & Antibody titre
- Preparation of Platelet concentrate, RCC, F.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.

IV. *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.

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 disciple 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.
   - (ii) Candidate has to secure 2nd division or GPA 2.5 in the SSC examination. Candidate passed S.S.C. exam current year or previous three years or as decided by the authority for each year of admission.

2. Current SSC & Previous 3 years, 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 organised by the respective Institute of Health/ Medical Technology .

D. Course structure and duration

The course will be of three years duration. The total period is divided into 3 parts – 1st year, 2nd year and 3rd year. In each year there will be 40 weeks ((Teaching/Learning hours: 900-1500 hours/year) of teaching and learning at the end of which there will be an year final examination. Supplementary examinations will be held 6 months of the year final examination.

Year	Institutional teaching	Clinical placement	Revision & exam
1st Year	36 weeks	-	04 weeks
2nd Year	36 weeks	-	04 weeks
3rd Year	18 weeks	18 weeks	04 weeks

E. **Setting of the papers & distribution of teaching /learning hours year wise:**

1st Year

Papers	Subjects	Theory	Tutorial	Practical /Demon	Total
I	English	75	25	-	100
II	Physics	50		50	100
III	Chemistry	80		20	100
IV	Basic Human Anatomy	70	60	70	200
V	Basic Human Physiology	75	60	65	200
VI	Community Medicine	150		50	200
VII	Basic Microbiology & Parasitology	40		30	70
	Total	540	145	285	970

2nd Year

Papers	Subjects	Theory	Practical/ Demonstration	Total Hours
Paper I	Laboratory Technique	77	178	255
Paper II	General Microbiology	41	58	99
	Parasitology	66	112	178
Paper III	Clinical Pathology	57	102	159
	Haematology	58	106	164
Paper IV	Clinical Chemistry (General)	89	178	267
Paper V	Basic Computer Science	25	75	100
	Total	413	809	1222

3rd Year

Papers	Subjects	Theory	Practical / Demonstration	Field/Hospital placement	Total Hours
Paper I	Clinical Chemistry (Special)	47	94	-	141
	Serology, Immunology & Hormonal Assay	59	100	-	159
Paper II	Special Microbiology	90	180	-	270
Paper III	Histopathology & Cytopathology	70	130	-	200
	Blood Banking	35	70	-	105
	Medical College Hospital placement	-	-	600	600
	Total	301	574	600	1475

F. **Teaching & learning methods**

The following teaching and learning methods will be followed:

1. Large Group Teaching Lecture aided by –
   - White board, Marker
   - OHP/ Slide projector/Laptop
   - Handouts
2. Small Group Teaching-
   - Tutorial
   - Demonstration
   - Students interaction
3. Practical session-
   - Use of practical manual White board
   - Performing the task/examination by the student
   - Writing the practical note book
4. Field Placement-
   - In small groups for performing activities by the student themselves

G. Assessment methods, grading and pass marks

Assessment Methods:

A. There will be in-course (card/ item) and end-course (terminal) assessment for the students in each part (1st, 2nd & 3rd year) of the course i.e. formative and year final examination.
B. There will be year final examinations at the end of each academic years and one supplementary examination 6 months after each regular year-final examination.
C. Formative assessment will be done through items and card ending exam.
D. In the year-final examination marks allocation will be as follows:
   - 20% from the formative examinations (Card final examination/Item marks).
   - 80% from year-final examination
E. 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 atleast 50% marks in the formative examinations.
   - No objection Certificate from the head of the respective heads 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 Final examinations unless the student passes in all the subjects of 1st and 2nd year Final examinations respectively.

Grading	***Pass Marks/Grade-C***
*1. Grade **A+** : 75% and above*	*Written Exam - 50%*
*2. Grade **A**: 60% - 74%*	*Practical - 50%*
3. Grade **B**: 45% - 59%	Oral - 50%

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

H. Examinations & distribution of marks:

First Year Examination

Paper	Subjects	Written Exam	Oral Exam	Practical Exam	Formative Exam	Total Marks
I	English	100	-	-	-	100
II	Physics	75	10	15	-	100
III	Chemistry	75	10	15	-	100
IV	Basic Human Anatomy	100	40	40	20	200
V	Basic Human Physiology	100	40	40	20	200
VI	Community Medicine	100	40	40	20	200
VII	Basic Microbiology & Parasitology	100	40	40	20	200
	TOTAL	650	180	190	80	1100

Second Year Examination

Paper	Subjects	Written Exam	Oral Exam	Practical Exam	Formative Exam	Total Marks
I	Laboratory Technique	100	40	40	20	200
II	General Microbiology & Parasitology	100	40	40	20	200
III	Clinical Pathology & Haematology	100	40	40	20	200
IV	Clinical Chemistry (General)	100	40	40	20	200
V	Basic Computer Science	50	25	25	-	100
	Total	450	185	185	80	900

Third Year Examination

Paper	Subjects	Written Exam	Oral Exam	Practical Exam	Formative Exam	Total Marks
I	Clinical Chemistry (Special), Serology, Immunology & Hormonal Assay	100	40	40	20	200
II	Special Microbiology	100	40	40	20	200
III	Histopathology, Cytology & Blood Banking	100	40	40	20	200
	TOTAL	300	120	120	60	600

Paper I: Subject - English

Total hours: 100 hour **Total marks-50+50**
Lecture: 66 hour (Lt No = 66) **Written-50+25**
Practical / Tutorial: 34 hours (Pract No = 34) **Oral & practical- 25**

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

1. Read & write any story in English and attain HSC level English proficiency
2. Write letters in English (private, Official etc).
3. Translate & retranslate in English
4. Read and write essays on different topics in English
5. Develops listening skills in English
6. Communicate with each other in English

Course Contents of English (Part –I) ***Marks = 50***

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical
1.	**Text book: English for Today-Published by N.C.T.B. (Intermediate)** **Unit- Three:Learning English.** 1. Learning a language 2. Why learn English 3. How to learn English 4. Different learners, different ways 5. Dealing with grammar 6. Integrated skills development 7. How well do I know my dictionary? **Unit-Six: Our Environment.** 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. **Unit-Twenty-four: People, People Everywhere** 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	
		Theory	Practical
2.	**Grammar:** **Articles :** ▪ Indefinite & definite articles **Tense:** ▪ Present, Past & Future tense **Voice :** ▪ Active voice ▪ Passive voice ▪ Voice change **Speeches:** ▪ Direct speeches ▪ Indirect speeches **Linkers** ▪ In addition ▪ Besides ▪ Moreover ▪ However ▪ Because ▪ Either or neither, nor **Idioms & Phrases :**	22	
	Paragraph writing : **Letter writing:** **Application writing:** **Report writing :**	10	
	Telegrams & E-mail:	2	
	Total	50	

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

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	**Practical**
	Communicative English : ▪ Reading skill ▪ Writing skill ▪ Listening skill ▪ Conversations skill	 4 4 4 4	 8 8 8 10
	Total	16	34

Teaching Methods:

Lecture
Practical/ Tutorial/Communication

Media:

Multi media,
Laptop,
OHP,
White Board,
Marker,
Wall chart
VCD, DVD, CD

Assessment:

Written - SAQ (50% + 25%)
Reading, Listening & conversation 25%

Paper II : Subject - Physics

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

1. Define Physics and state the importance of Physics in the Health Care System.
2. Explain the different systems of measurement and weights.
3. Demonstrate basic knowledge on measurement of density and specific gravity of a substance.
4. Demonstrate basic knowledge on fundamental aspects of heat and temperature, sound, light, electricity and magnetism.

Course contents of Physics

Sl.No	Topic/Lessons তত্বীয়	Teaching/Learning Hours	
		Theory	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 সংরক্ষণনীতি। ➢ সরল দোল গতি, সরল দোলক ➢ আর্কিমিডিসের সূত্র ও তার প্রয়োগ আপেক্ষিক গুরুত্ব নির্ণয়।	১০ ঘন্টা	
২।	**তাপ ঃ** তাপমিতি, তাপের একক, আপেক্ষিক তাপ, তাপীয় ক্ষমতা পানিসমও সুপ্ততাপ এবং ইাহাদের নির্ণয় পদ্ধতিঃ সরলীয় পদ্ধতিতে তাপের পরিবাহিতা নির্ণয়।	৫ ঘন্টা	
৩।	**শব্দ ঃ** ➢ শব্দের উৎপক্তি 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।	৬ ঘন্টা	
৫।	**চুম্বক ঃ** ➢ চুম্বকনের বিভিন্ন পদ্ধতিঃ চুম্বকের মতবাদ চুম্বকের ক্ষেত্র ও প্রবাল্য। বিপরীত বর্গীয় সূত্র প্রান্তমূখী ও প্রস্থমূখী অবস্থানে চুম্বকের প্রাবল্য। বিক্ষেপী চুম্বকমান যন্ত্র ও ইহার ব্যবহার। ➢ ভুচুম্বকত্ব।	৪ ঘন্টা	

Sl.No	Topic/Lessons	Teaching/Learning Hours	
		Theory	Practical
৬।	**তড়িৎ ঃ** ➢ স্থির তড়িৎ, 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। ➢ গুহমের সূত্র, বিভব বৈষম্যের একক। রোধ ও আপেক্ষিক রোধ, রোধের একক, রোধ সংযোজন, এমিটার, ভোল্ট মিটার। ➢ বৈদ্যুতিক পরিমাপ, হুইট স্টোম 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।	২০ ঘন্টা	
	ব্যবহারিক		
	১। স্ক্রাইড 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 দুরত্ব নির্ণয়। ৭। প্যারালাক্স পদ্ধতিতে উত্তল লেন্স ফোকাস দুরত্ব নির্ণয়। ৮। একখানা কাচ ফলকের প্রতিসরাংক নির্ণয়। ৯। ওহমের সূত্রের সত্যতা নির্ণয়। ১০। যে কোন দৈর্ঘ্যের তারে আপেক্ষিক রোধ নির্ণয়। ১১। নাল পদ্ধতিতে দুইখানা দন্ড চুম্বকের চৌম্বক ভ্রামকের তুলনা।		৩ ঘন্টা ৬ ঘন্টা ৩ ঘন্টা ৩ ঘন্টা ৫ ঘন্টা ৩ ঘন্টা ৩ ঘন্টা ৩ ঘন্টা ৩ ঘন্টা ৩ ঘন্টা ৫ ঘন্টা
	মোট ঃ ১০০ ঘন্টা	৬০	৪০

মান বন্টন ঃ তত্বীয় = 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 চুম্বকতত্ব ঃ প্রতিটি শাখা থেকে ৪ নম্বরের ৪টি করে মোট ১২টি প্রশ্ন থাকবে। সেগুলোর মধ্যে থেকে ২টি করে মোট ৬টি প্রশ্নের উত্তর দিতে হবে।

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

দ্রষ্টব্য ঃ 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 = ২৫
মৌখিক = ১৫
মোট ঃ তত্বীয়+ব্যবহারিক+মৌখিক = ১০০

Paper III : Subject - Chemistry

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

1. Describe fundamentals in physical chemistry.
2. Describe common laboratory process.
3. Identify organic and inorganic chemical compounds.
4. Explain the different aspects of metals, non-metal and gaseous substances.

Course contents of Chemistry

Sl.No	Topic/Lessons	Teaching/Learning Hours	
		Theory	**Practical**
	গ্রুপ-ক ভৌত রসায়ন		
	১। ভৌত ও রাসায়নিক পরিবর্তন ও এদের মধ্যে পার্থক্য।	১ ঘন্টা	
	২। পদার্থের গঠনঃ অণু ও পরমানু-অণুর সংজ্ঞা, আন্তঃআণবিক দুরত্ব, আন্তঃআণবিক, কঠিন, তরল, গ্যাস, পরমানু, পারমানবিক ও আনবিক ওজন।	৬ ঘন্টা	
	৩। সাধারণ পরীক্ষাগার প্রণালীঃ দ্রবণ, অভিস্রবণ, পরিস্রাবণ, সম্পক্ত, অসম্পক্ত, ও অতিপৃক্ত দ্রবণ, দ্রাব্যতা, বাস্পীভবন, পাতন, আংশিক পাতন, উর্ধ্বপাতন, কেলাসন।	৫ ঘন্টা 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 রাসায়কি ক্রিয়া, রাসায়নিক বিক্রিয়া ঘটানোর উপায় সমূহ।	৪ ঘন্টা	
	৬। অল্ল, ক্ষারক ও লবন।	২ ঘন্টা	
	৭। গ্যাসের ধর্ম-বয়েলের সূত্র, চার্লসের সূত্র।	২ ঘন্টা	
	৮। মৌলের রাসায়নিক তুল্যাংক বা যোজন ভার।	২ ঘন্টা	
	৯। পরমানুর গঠন এবং যোজ্যতার ইলেকট্রনীয় মতবাদ। বিভিন্ন রাসায়নিক বন্ধন।	৪ ঘন্টা ২ ঘন্টা	
	১০। ক) এভোগ্যাড্রে সূত্র খ) ভরক্রিয়া সূত্র।	৬ ঘন্টা	
	১১। রাসায়নিক সংযোগ বিধিঃ ক) ভরের নিত্যতা সূত্র। খ) নির্দিষ্ট অনুপাত সূত্র। গ) গুনানুপাত বিধি। ঘ) বিপরীত অনুপাত সূত্র। ঙ) গ্যাস আয়তন সূত্র।		
	গ্রুপ -খ অধাতু ঃ		
	১। নিম্নোক্ত পদার্থ গুলোর উৎস, প্রস্তুতি, ধর্ম এবং ব্যবহারঃ	১০ ঘন্টা	
	ক) অক্সিজেন, ওজোন, পানি ও হাইড্রোজেন পার অক্সাইড।		
	খ) হোলাজেন সমূহ ঃ ক্লোরিন, রোমিন, আয়োডিন ও হাইড্রো ক্লোরিক এসিড।		
	গ) নাইট্রোজেন, হাইড্রোজেন সালফাইট, সালফার ডাইঅক্সাইড, সালফিউরিক এসিড।		
	ঘ) সালফার, হাইড্রোজেন সালফাইট, সালফার ডাইঅক্সাইড, সালফিউরিক এসিড।		
	ঙ) ফসফরাস চ) জারন-বিজারনঃ জারক ও বিজারক পদার্থ	৮ ঘন্টা	
	২। ধাতুঃ নিম্নোক্ত পদার্থ গুলোর উৎস, প্রস্তুতি, ধর্ম এবং ব্যবহারঃ		
	ক) সোডিয়াম-সোডিয়াম হাইড্রোঅক্সাইড, সোডিয়াম কার্বনেট, সোডিয়াম ক্লোরাইড।		
	খ) ক্যালসিয়াম-ক্যালসিয়াম কার্বনেট, ক্যালসিয়াম ফ্লোরাইড, ক্যালসিয়াম সালফেট, বিচিং পাউডার।		
	৩। কপার -কপার অক্সাইড, কপার সালফেট, কপার ফ্লোরাইড	১ ঘন্টা	
	৪। জিংক - জিংক অক্সাইড, জিংক ফ্লোরাইড, জিংক সালফেট।	১ ঘন্টা	

Sl.No	Topic/Lessons	Teaching/Learning Hours	
		Theory	Practical
	৫। এলুমিনিয়াম - এলুমিনিয়াম ফ্লোরাইড, এলুনিয়াম সালফেট। ৬। আয়রন - আয়রন সালফেট। ৭। লেড - লেড অক্সাইড। ৮। সিলভার - সিলভার নাইট্রেট।	১ ঘন্টা ১ ঘন্টা ১ ঘন্টা ১ ঘন্টা	
	গ্রুপ - গ জৈব রসায়ন		
	১। জৈব রসায়নের সংজ্ঞা, জৈব ও অজৈব যৌগের মধ্যে পার্থক্য জৈব যৌগের গঠন, শ্রেণী বিভাগ, কার্যকরী বা ক্রিয়াশীল মূলক। ২। জৈব যৌগের নিষ্কাশন ও বিশুদ্ধকরণ ৩। সম্পৃক্ত ও অসম্পৃক্ত হাইড্রোকার্বনঃ প্রস্তুত প্রণালী, ধর্ম এবং ব্যবহার -মিথেন, ইথেন, ইথিলিন, এসিটাইলিন। ৪। এলকোহল হ্যালোজেন জাতকঃ মিথাইল ফ্লোরাইড, ক্লোরোফর্ম এর প্রস্তুতি, ধর্ম ও ব্যবহার। ৫। এলকোহলঃ শ্রেণী বিভাগ, মিথাইল এলকোহল, ইথানল এলকোহল ও গি-সারিনের প্রস্তুতি, ধর্ম ও ব্যবহার। ৬। ডাই-ইথাইল ইথারঃ প্রস্তুতি, ধর্ম ও ব্যবহার। ৭। এলডিহাইড ও কিটোল সমূহঃ নিম্নলিখিত যৌগসমূহের প্রস্তুতি, ধর্ম ও ব্যবহার, ফরমালড্রিহাইড, এসিটালডিহাইড ও এসিটোন। ৮। কার্বলিক এসিডঃ এসেটিক এসিড ও সাইট্রেক এসিসেডর প্রস্তুতি, ধর্ম ও ব্যবহার। ৯। এলকোহল এ্যামাইনঃ এ্যামাইনের শ্রেণী বিভাগ, মিথাইল এ্যামাইন ও ইথাইল এ্যামাইনের প্রস্তুতি, ধর্ম ও ব্যবহার। ১০। এ্যারোমেটিক যৌগঃ নিম্নলিখিত যৌগসমূহের প্রস্তুতি, ধর্ম ও ব্যবহার। বেনজিন, টলুইন, ফ্লোরোবেজিন নাইট্রোবেজিন, অ্যানিলিন, কার্বলিক এসিড, বেনজালডিহাইড, বেনজোয়িক এসিড ও স্যালিসাইলিক এসিড।	৪ ঘন্টা ১ ঘন্টা ২ ঘন্টা ৪ ঘন্টা ২ ঘন্টা ১ ঘন্টা ৩ ঘন্টা ৩ ঘন্টা ২ ঘন্টা ৫ ঘন্টা	
	ব্যবহারিক ঃ		
	১। অম্ল ও ক্ষারের মাত্রা নির্ণয়। ২। হাইড্রোজেন ও অক্সিজেনের প্রস্তুতি। ৩। সহজ জৈব ও অজৈব যৌগের আঙ্গিক বিশেষণ।		২০ ঘন্টা
	মোট ঃ ১০০ ঘন্টা	৮০ ঘন্টা	২০ ঘন্টা

মান বন্টন ঃ তত্ত্বীয় - ৬০
ব্যবহারিক - ১৫
মৌখিক -১০

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 অন্তঃপক্ষে ২টি করে মোট ৬টি প্রশ্নের উত্তর দিতে হবে।

Paper IV: Subject - Basic Human Anatomy

Total hours: 200 hour **Total marks-200**
Lecture: 70 hour (Lt No = 70) **Written-100**
Practical: 70 hours (Pract No = 35) **Oral & practical- 80**
Tutorial : 60 hours (Lt No. = 60) **Formative- 20**

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

1. Demonstrate a comprehensive knowledge base above the major anatomical system and structure of human body
2. Identify major anatomical system and structure of human body
3. Identify the specific structures and organs and application of such knowledge in studying their individual disciplines.
4. Do surface marking of important organ of human body.

Course Contents of Basic Human Anatomy

Sl. No	Topics/Lessons	Teaching/learning Hours		
		Theory	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	10
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
5.	**Gastro-intestinal and Hepatobiliary system:** ▪ Short description of the different parts of alimentary system: mouth, tongue, oesophagus, stomach, small and large intestine, rectum & anal canal ▪ Anatomy of salivary glands, pancreas, liver, gall bladder	10	10	10
6.	**Genito –urinary system:** ▪ Anatomy of urinary system ▪ Male genital system: ▪ Female genital system	10	10	10

Sl. No	Topics/Lessons	Teaching/learning Hours		
		Theory	Tutorial	Practical/ Demonstration
7.	**Nervous system and Endocrine system.** ▪ Basic structure of nervous system ▪ Parts of nervous system and short description of brain,, spinal cord, cranial nerves, peripheral nerves ▪ Autonomic nervous system and short description of sense organs-eye, ear, nose, tongue and skin ▪ Important endocrine glands	12	12	10
8.	**Lymphatic System :** ▪ Anatomy of lymph nodes and vessels	2	2	
	Total =	70	60	70

Teaching Methods:

Lecture
Tutorial
Practical/ Demonstration

Media:

Multi media,
Laptop,
OHP,
White Board,
Marker,
Skeleton
Wall chart

Assessment:

Written - SAQ (50%)
Practical (20%), Oral (20%), formative (10%)

Paper V: Subject - Basic Human Physiology

Total hours: 200 hour
Lecture: 75 hour (Lt No = 75)
Practical: 66 hours (Pract No = 33)
Tutorial : 59 hours (Lt No. = 59)

Total marks-200
Written-100
Oral & practical- 80
Formative- 20

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

1. Demonstrate a comprehensive knowledge on functional aspects of different important systems, components and organs of human body.

2. Apply the practical knowledge of human physiology in studying and performing the allotted tasks in their individual disciples.

Course Contents of Basic Human Physiology

Sl. No	Topics/Lessons	Teaching/learning Hours		
		Theory	Tutorial	Practical/ Demonstration
1.	**Introductory Physiology:** ▪ 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	06
	Musculoskeletal system : ▪ Physiological components of musculoskeletal system ▪ Functions of important muscles, bones & joints of human body ▪ Movements of joints	10	10	10
	Cardiovascular System: ▪ 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		
		Theory	Tutorial	Practical/ Demonstration
	Respiratory system : ▪ Functions of respiratory system ▪ Mechanism of breathing	05	05	10
	Digestive and hepatobiliary system: ▪ Definition of digestion, absorption, metabolism ▪ Digestion, absorption & metabolism of carbohydrate, fat protein ▪ Nutritional deficiency disorders : anaemia, iodine deficiency, vitamin deficiencies ▪ Functions of liver, pancreas and gall bladder ▪ Composition & functions of different digestive juices & bile	10	10	10
	Genitourinary system: ▪ 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
	Nervous system, organs of special sense: ▪ 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
	Immune System : ▪ Definition/classification and components of immune system ▪ Cells and tissues of immune system & their functions	05	05	
	Lymphatic System : ▪ Composition & functions of lymph nodes and vessels	03		
	Total =	75	59	66

Teaching Methods:

Lecture
Tutorial
Practical/ Demonstration

Media:

Multi media,
Laptop,
OHP,
White Board,
Marker,
Wall chart
Lab. Reagent & Apparatus

Assessment:

Written - SAQ (50%)
Practical (20%), Oral (20%), formative (10%)

Paper VI : Subject – Basic Community Medicine

Total hours: 200 hour **Total marks-200**
Lecture: 150 hour (Lt No = 150) **Written-100**
Practical / Tutorial : 50 hours (Pract No = 25) **Oral & practical- 80**
Formative- 20

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

1. Describe the general aspects of community medicine
2. Describe the basic concepts of epidemiology
3. Describe the concept of primary health care
4. Define organisations of health services and major health programmes in Bangladesh
5. Carry on elementary bio-statistics
6. Enumerate the concept of demography and family planning
7. Define maternal and child health (MCH), describe its objectives and explain the importance of ante-natal and post-natal care for mother and children
8. Define food and nutrition and be aware of nutritional problems in Bangladesh
9. Be aware of occupational health hazards and their preventive and protective measures
10. Describe the principles of health education and their application in the community
11. Be aware of environmental pollution and methods of prevention and control of pollution
12. Enumerate the basic concept of Essential Service Package (ESP)

Course Contents of Basic Community Medicine

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical/ Demonstration
1.	**Introductory community medicine:** ▪ Definition of Community Medicine ▪ Concept of health : Definition / Dimensions / 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:** ▪ Definition/Elements/ Principles/Scope	05	02
3.	**Health care services and organization:** ▪ Primary/Secondary/Tertiary Health Care services ▪ WHO/UNDP/UNICEF/CARE/ International Red Crescent ▪ BIRDEM / ICDDR,B	06	02
4.	**Basic Epidemiology:** ▪ 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/ Isolation/ Quarantine etc. ▪ Major health programmes in Bangladesh ▪ Medical Information system (MIS)	12	06

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical/ Demonstration
5.	**Basic Bio-statistics :** ▪ 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
6.	**Demography and family planning**.: ▪ 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/ Indication/ Contra indication/ Complications	12	04
7.	**Maternal and Child Health Care (MCH):** ▪ 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:** ▪ Food: Definition/Functions/Classification ▪ Sources/types/function/daily requirements and deficiency of protein, fat, carbohydrate, vitamins and mineral ▪ 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 Anaemia/ Lathyrism	15	06
9.	**Occupational Health :** ▪ Occupational health : Definition /Objectives ▪ Occupational Hazards: Introduction /Types ▪ Occupational disease: Definition/Classification/Prevention and control	08	02
10.	**Health education behavioral science and Ethics:** ▪ Health Education: Definition/Importance / Objectives / Components/ Principles/Methods/Media of ▪ Communication Skills: Definition/Key elements /Barriers ▪ Behavioural Science : Introduction & concept ▪ Ethics: Introduction and concept	12	04

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical/ Demonstration
11.	**Environment and sanitation:** ▪ Definition of pollution, environment, 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 impratnce/Health hazards/how disease occurs from it/Sanitation Barrier/ Methods of excreta disposal (Unsewered area/Sewered area)	25	04
12.	**First Aid :** ▪ 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
12.	**First Aid :** ▪ 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,
Wall chart
Models & Samples

Assessment:

Written - SAQ (50%)
Practical (20%), Oral (20%), formative (10%)

Paper VII: Subject -Basic Microbiology & Parasitology

Total hours: 75 hour **Total marks-200**
Lecture: 35 hour (Lt No = 35) **Written-100**
Practical : 40 hours (Pract No = 20) **Oral & practical- 80**
Formative- 20

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

1. Demonstrate basic knowledge about general aspects of different micro organisms including classification and general characteristics of protozoa, bacteria, virus & fungus
2. Perform common methods of identification of different micro organisms particularly bacteria & fungus of medical importance
3. Perform the technique of cleaning, disinfections, decontamination & sterilization in neutron to destruction of micro organisms in laboratory practices.

Course Contents of Basic Microbiology & Parasitology

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical/ Demonstration
1.	**Introduction to micro organisms :** ▪ Definition and classification of micro organisms ▪ Microbiological terminology ▪ Characteristics of Eukaryotic prokaryotic & sub cellular groups of micro organisms ▪ Microbiological articles, equipment's apparatus ▪ Microscope: Different parts of microscope, & maintenance of microscope	06	08
2.	**Destruction of micro organism :** ▪ Cleaning, Washing, decontamination disinfection & procedures ▪ Sterilization of different laboratory articles, instruments, glass wares etc.	03	04
3.	**Bacteria :** ▪ 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 & Pathogenecity ▪ Staining bacteria: Gram's staining, AFB staining, Albert staining	15	12

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical/ Demonstration
4.	**Virus :** ▪ General characters of virus ▪ Morphology & classification of virus ▪ List of viruses of medical importance & diseases produced by them	03	04
5.	**Fungus :** ▪ General character, Morphology and classification of fungus ▪ List of fungus list medical important and the diseases produced by them	03	04
6.	**Parasite :** ▪ Definition /Classification of parasite	01	02
7.	**Helminth:** ▪ General characteristics of helminths ▪ Classification /Morphology of helminths	03	04
8.	**Protozoa :** ▪ General characteristics of protozoa ▪ Definition /Classification of protozoa	01	02
	Total =	35	40

Teaching Methods:

Lecture
Tutorial
Practical/ Demonstration

Media:

Multi media,
Laptop/Computer,
OHP,
White Board,
Marker,
Wall chart
Models & Samples

Assessment:

Written - SAQ (50%)
Practical (20%), Oral (20%), formative (10%)

SECOND YEAR

Paper I: Subject- Laboratory Technique

Total hours: 255 hour
Lecture: 77 hour (Lt No = 77)
Practical: 148 hours (Pract No = 74)
Field visit : 30 hours (visit = 06)

Total marks-200
Written-100
Oral & practical- 80
Formative- 20

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

1. Demonstrate a sound knowledge base on basic medical laboratory matters and techniques.
2. Demonstrate knowledge about the role of laboratory in health care service and is able to set up and organise a Medical Laboratory.
3. Carry out the role and responsibilities of a Medical Laboratory Technologist
4. Demonstrate skills in effective laboratory communication, weighing and measurements
5. Demonstrate knowledge about operational safety and carry out emergency management and first aid in case of laboratory accidents, hazards and infections.
6. Prepare and maintain records and reports, store and stock ledger and use/ operate laboratory equipments, apparatus, chemicals & reagents.
7. Maintain professional code of conduct.

Course Contents of Laboratory Technique

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical/ Demonstration/ Field visit (each 02 hours)
1	*Role of laboratory in the health care and training of laboratory personnel:* ❑ 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	*Medical laboratory services at different levels*: ❑ Community based primary health care laboratory at THC 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	03	F-03 (15 hrs)
3	*Effective communication/ chaining in the laboratory*: ❑ Definition of communication ❑ Three ways of communication – writing, speaking & actions ❑ Guidelines for effective communication in the laboratory	03	F-01(05 hrs)

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	**Practical/ Demonstration/ Field visit (each 02 hours)**
4	*Laboratory policies &* : ❑ Setting up a medical laboratory ❑ Laboratory hours and emergency work ❑ Work load/capacity of the laboratory	03	F-01(05 hrs)
5	*Safety in the laboratory*: ❑ 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.	10	P-12
6.	*Code of safety for medical laboratory*: ❑ 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	
		Theory	Practical/ Demonstration (each 02 hours)
7	*Equipment for a medical laboratory*: ❑ 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 talley 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	37	P-112
8	*Records and reports:* ❑ 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.	04	P-04

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical/ Demonstration (each 02 hours)
9	*Health Service structure in Bangladesh and Patient Care*: ❑ 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	10	P-16
	TOTAL = 254 HOURS	77	177

Teaching Methods:

Lecture
Tutorial
Practical
Field visit

Media:

Multi media,
Laptop,
OHP,
White Board,
Marker,
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.)
Hospital/ Health complex.

Assessment:

Written - SAQ (50%)
Practical (20%), Oral (20%), formative (10%)
Objective Structured Practical Examination (OSPE)

Paper II: Subject - General Microbiology & Parasitology

1. General Microbiology

Total hours: 277 hour
Lecture: 107 hour (Lt No = 107)
Practical & Field Visit: 170 hours (Pract No = 85)

Total marks-200
Written-100
Oral & practical- 80
Formative- 20

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

1. Demonstrate an adequate knowledge base on different parts of microbiology, general description of micro organism including classification, structure & biology of micro organism.
2. Describe the operational safety in microbiology laboratory.
3. Maintain World Health Organisation safety code of practice for microbiological laboratory.
4. Perform sterilisation and disinfection.
5. Learn how to operate, use and maintain important equipment and apparatus of microbiology laboratory.
6. Collect, transport and process the specimens for microbiological examinations.
7. Perform staining of different micro organism.
8. Prepare, sterilize and inoculate different cultural media.
9. Demonstrate knowledge on immunity, its type, immunization schedule, antigen and antibody reactions.

Course Contents of General Microbiology

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical/Demon
1.	*Microscope and Microscopy:* ❑ Types of microscope ❑ Parts of a compound microscope ❑ How a microscope works and its uses ❑ Trouble with microscope and its care ❑ Some Do's and don't do's in Microscopy	03	06
2.	*Safety in microbiology laboratory* ❑ Good laboratory practices ❑ Microbiology safety cabinets ❑ Laboratory infections: Classification and hazards ❑ Personal safety precaution in microbiology laboratory ❑ WHO safety code of practice for microbiology laboratory	06	04
3.	*Operation, use and maintenance of instruments:* ❑ 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

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical/Demon
4.	*Microbiological specimens*: ❑ Types of specimens ❑ Collection, packaging and despatch/transport and preservation of specimens	03	06
5.	*Bacterial pathogenecity and virulence*	03	-
6.	*Staining*: ❑ Definition, types & different steps of staining ❑ Gram's staining/ Z.N. staining/ Albert staining/staining for spore, capsule, flagella	08	13
7.	*Bacterial culture and media*: ❑ Definition and classification of culture and media ❑ Preparation of medically important media ❑ Sterilisation and inoculation of media	06	12
8.	*Immunity*: ❑ Definition and types of immunity ❑ Antigens and antibody/ Antigen- antibody reactions ❑ Immunisation schedule	05	F-01
	TOTAL = 99 HOURS	41	58

Paper II : Subject - General Microbiology & Parasitology

2. ***Parasitology***

Objectives:

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

1. Demonstrate comprehensive knowledge base on different aspects of medical parasitology such as definition & classification of parasites, life cycle of parasites of medical importance, clinical features and identification of different parasites.

2. Collect, preserve, transport and prepare specimens for examination and identification of different parasites, ovum, cyst, tropozoites and larva of medical importance.

3. Perform certain special methods/ techniques for identification of parasites.

4. Assure high quality in different steps of diagnostic parasitology.

Course Contents of Parasitology

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical/ Demon
1	*Parasites :* ❑ Definition and classification of parasites ❑ General aspects of life cycle of parasites	03	-
2	*Helminths*: ❑ Classification and morphology ❑ Life cycle & laboratory diagnosis of AL, AD, TT and EV	06	08
3	*Cestodes*: ❑ Classification and general characteristics of cestodes ❑ Morphology, life cycle and laboratory diagnosis of Taenia Saginata, Taenia Solium, Hymenolepis Nana and Echinococcus Granulosus	06	08
4	*Tremadotess*: ❑ Classification and general characteristics of tremadotes ❑ Morphology, life cycle and laboratory diagnosis of Fasciolopsis Buski, Fsciola Hpatica	04	04
5	*Protozoa*: ❑ Classification and general characteristics of protozoa ❑ Life cycle and laboratory diagnosis of Entamoeba Histolytica and E. Coli	03	06
6	*Arthropods*: ❑ Definition, Classification and general characteristics of arthropods ❑ Life cycle and prevention/control of mosquito, housefly, sandfly and lice	05	10
7	*Blood Parasites:* ❑ Classification, life cycle and laboratory diagnosis of blood parasites of medical importance such as Plasmodium, Leishmania, & Wuchereria	10	20

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	**Practical/ Demon**
8	*Quality assurance in parasitology*:		
	❑ Collection and transport of specimen	01	02
	❑ Use of equipment including microscope	04	08
	❑ Quality reagents and stains	02	04
	❑ Performance of techniques	01	02
	❑ Detection and recognition of parasites	02	04
	❑ Recording and reporting of results	02	02
9.	*Teqniques used to identify parasites*:		
	❑ Specimens in which parasites are found	01	02
	❑ Direct examination of faecal specimen of ova/larva of helminths such as AL/AD/EV/TT/SS/Taenia/Protozoas	04	08
	❑ Concentration techniques for faecal techniques- Formol Ether /Formol detergent and Floatation Techniques	03	06
	❑ Counting of helminth eggs	01	02
	❑ Preservation of parasites	01	02
	❑ Acridine orange technique for chromatoid bodies cyst	01	02
	❑ Faecal culture technique to differentiate hookworm species	02	04
10	*Laboratory diagnosis of different parasites*:		
	❑ Intestinal/Vaginal: Giardia Intestinalis/Trichomonus Vaginalis/Trichomonus hominis	04	08
	TOTAL =178 HOURS	**66**	**112**

Teaching Methods:

Lecture
Tutorial
Practical

Media:

Multi media,
Laptop,
OHP,
White Board,
Marker,
Laboratory (Microscope, Autoclave, Hot air oven Incubator, laminar flow, Refrigerator etc)
Hospital/Health complex /EPI

\Assessment:

Written - SAQ (50%)
Practical (20%), Oral (20%), formative (10%)
Objective Structured Practical Examination (OSPE)

Paper III : Subject - Clinical Pathology & Haematology

1. *Clinical Pathology*

Total hours: 323 hour **Total marks-200**
Lecture: 115 hour (Lt No = 115) **Written-100**
Practical and Field visit: 208 hours (Pract No = 104) **Oral & practical- 80**
Formative- 20

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

1. Explain relevant terms in clinical pathology.
2. Differentiate different normal and abnormal specimens such as urine, stool, CSF, semen, sputum & other body fluids & discharge for examination in clinical pathology laboratory.
3. Collect, preserve and prepare the specimens of urine, stool, CSF, semen, sputum & other body fluids & discharge for diagnostic examination.
4. Understands the principles and carry out the steps involved in Physical/ Chemical/ Microscopical / Bacteriological examinations of different specimens and smears of urine, stool, CSF, semen, sputum & other body fluids & discharges.

Course Contents of Clinical Pathology

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Pract/Demon
1	*Introduction to clinical pathology & terminologies*	02	-
2	***Urine examination***		
	❑ Characteristics and composition of a normal & abnormal specimen of urine	03	-
	❑ Reasons for testing urine	01	-
	❑ Collection and preservation of urine for: Physical/ Chemical/ Microscopic & microbiological examinations	05	10
	Physical examination: ❑ Amount/ Colour/ Odour ❑ Transparency and sediments ❑ Specific Gravity	02	04
	Chemical examination: ❑ Determination of reaction ❑ Detection of Albumin/ Protein/ Sugar/ Acetone/ Bile salts & pigments/ Bence Jones Protein/ Blood/ Chyle etc	08	16
	Microscopical examinations: ❑ General technique ❑ Centrifugation of urine ❑ Preparation of urine slide for microscopic examination- Organised deposits/ Unorganised deposits/ Others	03	06

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Pract/Demon
3	***Stool examination***		
	Collection and preservation of faeces: ❑ For Physical/ Chemical & microscopical examinations *Physical examination*: ❑ Consistency/Amount/ Colour/ Odour/Mucus/Blood *Chemical examination*: ❑ Determination of reaction ❑ Test for Lactose/Reducing substances/ Urobilin / Bilirubin/ fat ❑ Test for Occult Blood *Microscopical examination*: ❑ Preparation of slide: stained and unstained ❑ Saline stool smear/Iodine stool smear ❑ Formal ether conc. test ❑ Floatation concentration method	02 01 05 05	04 02 10 10
4	*Cerebro Spinal Fluid (CSF)*: ❑ Source of CSF ❑ Collection: Lumbar puncture ❑ Features of Normal CSF : Physical/ Chemical/ Cytological and Bacteriological ❑ Examination of CSF: Physical/ Chemical/ Cytological examinations	05	10
5	*Examination of semen/ seminal fluid:* ❑ 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)	05	10
6	*Examination of sputum:* ❑ 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	05	10
7	*Examination of body fluid & discharges:* ❑ Procedure of collection of body fluids such as pleural fluid, ascitic fluid etc ❑ Procedure for physical, chemical & microscopical examination of body fluids & discharges	05	10
	TOTAL = 159 HOURS	57	102

Paper III: Subject- Clinical Pathology & Haematology

2. Haematology

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

1. Demonstrate knowledge on functions and composition of blood.
2. Explain the development, functions and normal values of blood cells and the variations in morphology in abnormal situation.
3. Identify, use and take care of different instruments/ equipments/ apparatus used in a haematological laboratory.
4. Do the steps for collection of capillary/ venous/ arterial blood.
5. Do the correct use of anticoagulants in a haematological laboratory.
6. Extract serum and plasma from whole blood.
7. Follow the principles and procedure for estimation of haemoglobin & total counts of RBC.
8. Follow the principles and perform the procedure for estimation of PCV, MCV, MCH and MCHC.
9. Follow the principles and perform the procedure for estimation of doing total counts of WBC and platelets and differential count of WBC.
10. Follow the principles and procedure for measurement of ESR, Volume index, Colour index, Blood and plasma volume.
11. Follow the principles and perform the procedure for determining of BT, CT, PT, Calcium time, Clot retraction time & fragility of RBC's.
12. Follow the principles and perform the technique of obtaining bone marrow for haematological examination.
13. Carry out laboratory methods for identification of malarial parasites and Microfilaria in blood.

Course Contents of Haematology

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	**Pract/Demon**
1	*Introduction to Haematology*:		
	❑ Definition, function and composition of blood	01	-
	❑ Formation, development, functions and fate of different blood cells	01	-
	❑ Normal values of blood cells	01	-
	❑ Normal and abnormal blood cells	01	02
	❑ Apparatus used for examination of blood	01	02
	❑ Methods for cleaning apparatus	02	04
	❑ Methods for collecting capillary blood/ venous blood	02	04
	❑ Anticoagulants used in the haematological laboratory	01	02
	❑ Techniques for separation of serum & plasma	01	02
	❑ Anaemia: Definition and classification	02	-
2	*Haemoglobin estimation:*		
	❑ Principle	01	02
	❑ Sahli's Method		
	❑ Cyanmethhaemoglobin method	01	02
	❑ Method for haemoglobin electrophoresis	02	04
	❑ Thin and thick blood films preparation	02	04
	❑ Counting Red Blood Cells: Principles, procedures & sources of error	05	10
3	*Principles and procedures for determining:*		
	❑ Packed Cell Volume (PCV)		
	❑ Mean Corpuscular Volume (MCV)	08	16
	❑ Mean Corpuscular Haemoglobin (MCH)		
	❑ Mean Corpuscular Haemoglobin Concentration (MCHC)		
	❑ Method for counting total leukocytes count	02	04
	❑ Method for differential count of WBC	02	04
	❑ Method for measuring erythrocytes: Principle/ Procedure	02	04
	❑ Method for counting Reticulocytes	01	02
	❑ Method for counting Thrombocytes	02	04
4	*Methods for determining:*		
	❑ Erythrocyte Sedimentation Rate (ESR)	03	06
	❑ Volume Index/ Colour Index/ Saturation Index		
	❑ Blood and Plasma volume –Principles, procedures & sources of error		
5	*Principles and Procedures for determining:*		
	❑ Coagulation Time (CT)	10	20
	❑ Bleeding Time (BT)		
	❑ Prothrombin Time (PT), APTT, Factor assay		
	❑ Calcium Time , Fibrinogen, D-Dimer test		
	❑ Clot Retraction Time		
	❑ Fragility of RBC's		
6	*Principles and technique of obtaining bone marrow for examination*	01	02
7	*Principles and procedures for identification of Malarial, Filarial and Leishmanin parasites in blood*	03	06
	TOTAL = 164HOURS	58	106

Teaching Methods:

Lecture
Tutorial
Practical

Media:

Multi media,
Laptop,
OHP,
White Board,
Marker,
Laboratory: (Microscope, Haematological cell counter, Haematocrit Centrifuge Machine, Refrigerator)
Hospital/Health complex.

Assessment:

Written - SAQ (50%)
Practical (20%), Oral (20%), formative (10%)
Objective Structured Practical Examination (OSPE)

Paper IV: Subject– Clinical Chemistry (General)

Total hours: 267 hour
Lecture: 89 hour (Lt No = 89)
Practical: 178 hours (Pract No = 89)

Total marks-200
Written-100
Oral & practical- 80
Formative- 20

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

1. Demonstrate a theoretical knowledge base on different aspects of clinical chemistry such as analytical methods, principles of chemical reactions etc.

2. Identify, use and operate biochemical equipment, apparatuses and glasswares.

3. Prepare, procure and use biochemical reagents and solutions.

4. Plan and organise a clinical chemistry laboratory.

5. Operate and describe the principles and perform calorimetry, spectrophotometry, Flame Emission spectrometry and autoanalysis for different biochemical examinations.

6. Demonstrate knowledge & apply different units of reporting biochemical results.

Course Contents of Clinical Chemistry (General)

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical/ Demon
1	*Introduction to clinical chemistry:* ❑ 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 ❑ How to dilute solutions and body fluids/solutions ❑ Safe use and storage of chemicals & reagents	20	40
2	*Colorimetry and spectrophotometry, Flame Emission spectrometry and Autoanalyser*: ❑ 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	20	40
3	*ELISA reading:* ❑ Methods of ELISA reading ❑ Handling of micropipette ❑ Mathematical calculation from reader	08	16

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical/ Demon
4	*SI Units in clinical chemistry :* ❑ Introduction ❑ SI base Units/ SI derived Units/ Named SI derived Units/ SI Units prefixes ❑ Application of SI Units in clinical chemistry ❑ Conversation of units gram/mol/mmol/µmol/international unit (IU)	08	16
5	*Reference range*: ❑ 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	20
6	*Tests for Renal function*: ❑ 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	15	30
7.	*Biochemical tests for metabolic diseases*: ❑ Measurement of plasma glucose ❑ Glucose Tolerance Test (GTT) ❑ Testing urine for glucose/ Ketone bodies Measurement of serum total calcium	08	16
	TOTAL = 267 HOURS	89	178

Teaching Methods:

Lecture
Tutorial
Practical

Media:

Multi media,
Laptop,
OHP,
White Board,
Marker,
Laboratory (Colorimeter, Spectrophotometer, Micropipette, Auto analyzer, ELISA Reader, Flame Photometer, Electrolyte analyzer)
Hospital/Health complex.

Assessment:

Written - SAQ (50%)
Practical (20%), Oral (20%), formative (10%)
Objective Structured Practical Examination (OSPE)

Paper V: Subject - Basic Computer Science

Total hours: 100 hours **Total marks-100**
Lecture: 25 hours (Lt No = 25) **Written-50**
Practical / Tutorial: 75 hours (Practical No = 75) **Oral & practical- 50**

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

1. Acquainted with the modern computer technology
2. Develop skills in MS Word, MS-Excel, Power Point, Internet
3. Prepare reports of various investigations
4. Collect latest information through internet

Course Contents of Basic Computer Science

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical / Tutorial
1.	**Detailed Contents :** **Relevant Instruction for Practical :** ▪ 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, alpha 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, parallet 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 MS-DOS 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	

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical
	▪ 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		
	▪ **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 colour, 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, thesaurus word content and statistics, printing envelops and lables ▪ **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	
		Theory	Practical
	MS -Excel : ▪ 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, organise, 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, deletion 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, customising a pivot table. Statistical analysis of data.** ▪ **Customise MS-Excel:** How to change view of worksheet, outlining a worksheet, customise 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
	Power Point : ▪ Making Slide ▪ Slide Projection		10
	Internet and its Applications : ▪ 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 marks = 100	25	75

Teaching Methods:

Lecture
Practical

Media:

Computer, Multi media, Computer Lab, Internet connection,White Board ,Marker

Assessment:

Written - SAQ (50%)
Oral and Practical - (50%)

THIRD YEAR

Paper I : Subject - Clinical Chemistry (Special) Immunology, Serology & Hormonal Assay

1. Clinical Chemistry (Special)

Total hours: 300 hour
Lecture: 106 hour (Lt No =106)
Practical: 194hours (Pract No = 97)

Total marks-200
Written-100
Oral & practical- 80
Formative- 20

Objectives: After completion of the course, a Medical Laboratory Technologist will be able to:

1. Demonstrate comprehensive knowledge base on different aspects of different biochemical tests such as principles, methods, procedures, analysis and recording of results.

2. Follow the principles and perform the procedures for different biochemical tests such as test for renal function, tests for liver, pancreatic and GI Tract, tests for metabolic diseases, tests for body fluids, tests for cholesterol, lipids & lipid profile, analysis of electrolytes.

3. Prepare biochemical reagents & chemical for use in the laboratories.

Course Contents of Clinical Chemistry (Special)

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical/ Demon
1	*Biochemical tests for liver, pancreatic and gastrointestinal tract*: ❑ Investigations for liver diseases (LFT): Measurement of serum or plasma – Total Bilirubin/Total protein /Albumin /Aspartate Aminotransferase / Alanine Phospate and Urine for bilirubin ❑ Investigations for pancreatic diseases: Serum or plasma Amylase/ Faeces for Occult blood test and excess fat/ Test for lactose in faeces (for lactose deficiency)	15	30
2.	*Biochemical tests for cerebro spinal fluid:* ❑ Measurement of CSF glucose, protein & chloride	03	06
3.	*Measurement of Serum Cholesterol*: LDL/ HDL/ Lipid Profile	05	10
4.	*Function and measurement of electrolytes:* ❑ Functions of electrolytes/ Electrolyte and water imbalance ❑ Conditions of Fluid imbalance ❑ Electrolytes and Acid Base balance/cardiacenzyme ❑ Disturbances of Acid-Base balance ❑ Measurement of sodium , potassium and bicarbonate in serum and plasma, and chloride ❑ Serum quantitative estimation of chloride in urine	15	30
5.	*Miscellaneous:* ❑ Preparation of reagents for Biochemical tests ❑ Biochemical tables and charts	 05 02	 10 04
6.	*Quality control in Clinical Chemistry*	02	04
	TOTAL = 141 HOURS	47	94

Paper I: Subject– Clinical Chemistry (Special), Immunology, Serology & Hormonal Assay

2. Immunology, Serology & Hormonal Assay

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

1. Demonstrate knowledge on the principles of immunity and the factors affecting it.

2. Apply the principles of application of basic immunological/ serological techniques in diagnosing microbial diseases and hormonal disorders.

3. Perform the procedures for immunological and serological tests.
4. Carry out the methods of hormone assay for facilitating detection of certain hormones.

Course Contents of Immunology, Serology & Hormonal Assay

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	**Practical/ Demon**
1	*Principles of immunity*: ❑ Definition and types of immunity ❑ Short description of different types of immunity ❑ Factors affecting immunity ❑ Harmful effects of immunity ❑ Antigen (Ag) and antibody (Ab)	05	-
2	*Serological diagnosis of microbial diseases*: ❑ Application of serological methods in diagnosing microbial diseases ❑ Serological techniques: Ag test, Ab test, Agglutination test, Precipitation test, Immunofluoroscent test, Enzyme Linked Immuno Sorbade Assay (ELISA), Complement Fixation Test (CFT), Radio Immuno Assay (RIA) PCR, IFAT ❑ Factors that influence the use of serological tests ❑ Principles and methods of following serological tests: RIA, ASO titre, Widal test, VDRL, TPHA, RA test, Rose Waller test, Antinuclear Ab test, HBsAg (ELISA Method) ❑ Principles and methods of following special immunological tests: Hepatic marker, Tumour marker, Drug marker, Fertility marker Testing urine for haemoglobin	05 10 04 10 10	10 20 - 20 20
3	*Hormone Assay:* ❑ Principles and methods ❑ Thyroid function tests ❑ Assays of FSH, Prolactin, Oestrogen, Progesterone, Testosterone, ACTH, ADH (Aldosterone) Factors that influence the use of serological tests	15	30
	TOTAL = 159 HOURS	59	100

Teaching Methods:

Lecture
Tutorial
Practical

Media:

Multi media,
Laptop,
OHP,
White Board, & Marker,
Laboratory: (Colorimeter, spectrophotometer, Micropipette, Auto analyzer, ELISA Reader Flame photometer, Electrolyte analyzer)
Hospital/Health complex.

Assessment:

Written - SAQ (50%)
Practical (20%), Oral (20%), formative (10%)
Objective Structured Practical Examination (OSPE)

Paper II: Subject - Special Microbiology

Total hours: 270 hours
Lecture: 90 hours (Lt No = 90)
Practical: 180 hours (Pract No = 90)

Total marks-200
Written-100
Oral & practical- 80
Formative- 20

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

1. Demonstrate an adequate knowledge base on different aspects of microbiology related to pathogenecity and antigenecity of bacteria of medical importance.
2. Describe operational safety of microbiology laboratory.
3. Appreciate the importance of World Health Organisation safety code of practice for microbiological laboratory.
4. Learn how to operate, use and maintain important equipment and apparatuses.
5. Collect, transport and process the specimens for microbiological examinations.
6. Perform an antimicrobial sensitivity testing on bacterial growth/ colony.
7. Perform a biochemical testing of micro organism.

Course Contents of Special Microbiology

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical/ Demon
1	*Special Bacteriology*: ❑ Morphology, classification, staining reaction, cultural characteristics, biochemical reactions, pathogenecity and antigenecity of the following group of bacteria: Gram positive and negative cocci and bacilli- Staphylococcus, Streptococcus, Pneumococcus, Gonococcus, Myecobacterium, Corrynebacterium, Salmonella, Shigella, Escherecis, Proteus, Klebsiella, Vibrio, Clostridium, Spirochaetes, Pseudomonas	15	30
2	*Virology*: ❑ Morphology, composition, classification, characteristics, and transmission of the medically important virus: ❑ Viral infection, pathogenecity and immunity ❑ Collection and transportation of virus specimen ❑ Laboratory diagnosis of virus	05	10
3	*Microscopical examination of bacteriological specimen:* ❑ Unstained preparation- wet film saline preparation, hanging drop. ❑ Stained preparation – Gram stainig, AFB, ALbert, Giemsa's, Loefler's Methylene Blue and Hiss staining methods	10	20

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical/ Demon
4	*Culture of micro organism*: ❑ Classification of Media ❑ Preparation of important media – Nutrient broth, Nutrient agar, Blood agar, Chocolate agar, Mckonkey's agar, Loefler's serum slope, Robertson's cooked meat media, Loenstein's Jensen media and Monsur's media	10	20
5	*Inoculation and incubation of culture media*: ❑ Study of colonies, ❑ Isolation and identification of bacteria ❑ Culture of: Throat swab, urine, stool, blood, pus, sputum, & vaginal and rectal swab, body fluids	10	20
6	*Quality assurance in culturing micro organism:* ❑ Areas requiring quality control ❑ Control of specimens collection and transport ❑ Control of mirobiological techniques ❑ Control of culture media ❑ Control of stains and reagents ❑ Control of equipment ❑ Control of reporting and recording results	08	16
7	*Antimicrobial sensitivity testing:* ❑ Antimicrobial drugs/Resistance of bacteria to antimicrobials ❑ Sensitivity testing techniques ❑ Antimicrobial drug assays ❑ Limitations of antimicrobial sensitivity tests ❑ Stokes disc diffusion sensitivity testing technique ❑ Indirect and direct sensitivity testing ❑ Suggested antimicrobial contents of discs	10	20
8	*Biochemical testing of micro organisms*: ❑ Biochemical tests used to different bacteria: Bile solublity 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	*Procedure for laboratory diagnosis of fungus of medical importance:- Fresh examination of specimen for dermatophytes*	02	04
	TOTAL = 270 HOURS	90	180

Teaching Methods:

Lecture
Tutorial
Practical

Media:

Multi media,
Laptop,
OHP,
White Board,
Marker,
Laboratory (Microscope, Hot Air Oven, Autoclave Incubator, Laminar flow, Co_2 jar, Refrigerator)
Hospital/Health complex.

Assessment:

Written - SAQ (50%)
Practical (20%), Oral (20%), formative (10%)
Objective Structured Practical Examination (OSPE)

Paper III: Subject - Histopathology, CytoPathology &Blood Banking

1. ***Histopathology, CytoPathology***

Total hours: 305 hour
Lecture: 105 hour (Lt No = 105)
Practical: 200hours (Pract No = 100)

Total marks-200
Written-100
Oral & practical- 80
Formative- 20

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

1. Differentiate normal and abnormal tissues of human body.
2. Describe the function, operation and use of histopathological equipment, apparatus/glassware, and chemicals.
3. Identify histopathological specimen and collect, transport and preserve the same.
4. Describe the principles and steps of histopathological examination.
5. Prepare and use properly histopathological chemicals and reagents.
6. Process and prepare different cytopathological specimens for examination.

Course Contents of Histopathology, CytoPathology &Blood Banking

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical/ Demon
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	05	10
4	Collection, transport, preparation and preservation of histopathologica/cytological specimens (FNAC, PAP'S, Smear, HVS etc.)	10	20
5	Principles and methods of paraffin fixation, block preparation, section cutting, slide preparation and stainin,PAP MGG, H&E,PAS, MPO, AFB) and mounting for histopathological examinations	10	20
6	Function, operation and use of histopathological equipments, appararus, glass wares: ❑ Microtomy ❑ Paraffin bath/Water bath/ Hot Air Oven/Automatic tissue processor/Auto Staining Machine ❑ Incubator/ Block capsule/ Wax/ Refrigerator ❑ Coplin jar/ Specimen jars/ Slides/ Cover slides ❑ Mounting gum/ Diamond pencil(marker)/ Sharpening stone/Auto Knife sharpener	15	30
7	Preparation and use of histopathological chemicals and reagents	10	20
8	Collect, process and prepare different cytopathological smears such as of body fluids, aspirates and exudates for examination	10	20

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical/ Demon
9	Museum Techniques: ❑ Preservation of museum specimens ❑ Preparation of mounting solution (Kaicerling I,II,III) ❑ Care, mounting and displaying of specimens ❑ Cataloguing of Museum specimens	05	10
	TOTAL = 200 HOURS	70	130

Paper III: Subject - Histopathology, CytoPathology &Blood Banking

2. *Blood Banking*

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

1. State the principles of Blood Banking and Blood Transfusion.
2. Explain the basis of blood grouping and cross matching.
3. Appreciate the importance of Rh-factor in pregnancy.
4. Carry out the different cross matching for safer transfusion.
5. Organise a blood bank.
6. Maintain blood bank records.

Course Contents of Histopathology, CytoPathology &Blood Banking

Sl. No	Topics/Lessons	Teaching/learning Hours	
		Theory	Practical/ Demon
1	❑ 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 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	70
	TOTAL =105 Hours	35	70

Teaching Methods:

Lecture
Tutorial
Practical

Media:

Multi media,
Laptop,
OHP,
White Board,
Marker,
Laboratory: (Microscope, Hot Air Oven, Incubator, centrifuge machine, cell separator machine, Ultra Refrigerated centrifuge machine, Ultra freezer of -50^0c, Auto tissue processor, auto staining machine, paraffin bath, microtome machine with sharpener)

Hospital/Health complex.

Assessment:

Written - SAQ (50%)
Practical (20%), Oral (20%), formative (10%)
Objective Structured Practical Examination (OSPE)

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)
- Diploma in Medical Technology of Laboratory Medicine Course Curriculum for 2001