UNIVERSITY OF HEALTH SCIENCES, LAHORE

Department of Allied Health Sciences

Master of Science (M.Sc.) in Medical Technology

General Information:

The M.Sc. Medical Technology degree program, offered by UHS, is especially designed to meet the educational needs of clinical laboratory scientists in both laboratory medicine and research. The program will provide the training to the students that is necessary to stay current with the rapidly changing technology and prepare them to assume positions of greater responsibility. The proposed M.Sc. program in Medical Technology is mostly directed towards medical technologists who would like to improve their qualifications. The four disciplines included in M.Sc Medical Technology program are **histopathology, hematology & transfusion medicine, medical microbiology and chemical pathology together with a well balanced course in lab management and administration as well as in behavioral sciences.** The integration of these courses will provide the students with comprehensive knowledge to meet the educational needs of students who can be employed as medical technologists in medical laboratories, biotechnology and medical research as well as in tertiary care hospitals.

Admission Requirements:

M.Sc. in Medical Technology at UHS is highly competitive program. For admission, a student must have first or high 2nd division in:

- B.Sc. Medical Laboratory Technology
- B.Sc (Hons) Chemistry/Biology/Biotechnology
- M.B.B.S
- Entry Test / Interview

Program of Study:

Duration of M.Sc. program in Medical Technology is 2 years and will include classroom lectures, laboratory exercises, rotation in all disciplines of pathology and thesis in their chosen discipline of specialization. All students must complete course work and submit their research thesis within the prescribed time limit of their study periods (two years) to meet their master's requirement.

The curriculum of M.Sc. in medical technology is designed to allow students to achieve the following objectives to

- obtain up-to-date knowledge of foundations and recent advances in laboratory medicine.
- develop the ability to apply basic knowledge of laboratory medicine and basic sciences to advanced laboratory specialties.
- demonstrate competence in research theory and methodology in order to solve laboratory problems as economically and expeditiously as possible.
- acquire concepts of lab management, quality assurance and administrative skills.

The curriculum which is well balanced is constructed to allow students to work in all disciplines of pathology lab and to move to their area of specialization. Keeping in mind the fact that the medical laboratory technologist must be able to apply latest concepts and techniques of basic laboratory medicine so that the recent advances in this area shall also be covered.

Plan of Study:

All students shall undergo rotation in four disciplines of pathology (three months each) during the 1st year of their education. A satisfactory report from the concerned supervisor of student is compulsory. By the end of 1st year student will select his area of specialization. He will also select the topic of research and prepare synopsis for thesis.

All students must pass Year I courses before promotion to Year II. Students shall have to pass the examination in a maximum of total three attempts to enable him/her to continue his/her studies of second academic year.

During the 2nd year of education, the student will work in the field of specialization in any of the four disciplines of Pathology. In addition research work will be carried out on the approved project. Thesis will be submitted well in time before the end of 2nd year.

Curriculum for M.Sc Medical Technology:

The courses in the following subjects are compulsory for all students during the 1st academic year.

1. **Morbid Anatomy & Histopathology**
2. **Microbiology & Immunology**
3. **Hematology and Blood Transfusion**
4. **Chemical Pathology**

These courses include lectures as well as laboratory work. In addition the students shall be taught behavioral sciences and lab management during the 1st academic year.

Each student shall select his/her area of specialization from the above subjects to study in the second academic year.

Each student will be assigned the research topic by the supervisor and shall prepare and submit the synopsis to Synopsis Review Committee of Allied Health Sciences that will recommend and forward for approval to Advanced Studies and Research Board.

Each student will be responsible for preparation of his / her own thesis in the subject of specialization in consultation with the supervisor as per required specifications and criteria of the UHS.

Each student shall be responsible for defending his / her research thesis, for which a panel of three examiners (one internal, two external examiners) shall be formed.

Assessment:

Attendance in both theory as well as in practical classes is essential. Students with less than 75% attendance will not be allowed to take the final examinations. All the students will be examined in their respective disciplines and their performance shall be evaluated in following ways:

1. Class work
2. Continuous Assessment (in term of class test scheduled at a regular intervals)
3. Final Examination (Cumulative)

Final Examinations:

At the end of course work / laboratory training, each student with satisfactory attendance report shall be allowed to take the final examination. The format of written examinations paper shall be in the form of MCQ's, and SEQ's (short essays questions) for each subject:

(1). **EXAMINATION AT THE END OF 1st YEAR**

There shall be four written papers at the end of 1st academic year.

(i) The written paper of each subject shall be of 100 marks based on 45 MCQs (45 marks) and 9 SEQs(45 marks) with no choice, of three hours duration and 10 marks for internal assessment.

Paper I Morbid Anatomy & Histopathology
Paper II Microbiology/Immunology
Paper III Haematology & Transfusion Medicine
Paper IV Chemical Pathology

(ii) The Practical and Viva Voce examination of each subject will be of 100 marks.

	THEORY			PRACTICAL & ORAL		
	MCQs (45)	SEQs (9 out of 9)	Internal Assessment	Internal Examiner	External Examiner	Internal Assessment
PAPER I	45	45	10	45	45	10
PAPER II	45	45	10	45	45	10
PAPER III	45	45	10	45	45	10
PAPER IV	45	45	10	45	45	10

(2) **EXAMINATION AT THE END OF 2nd YEAR**

The area of specialization can be chosen from the following

a) Chemical Pathology **b) Microbiology** **c) Immunology**
d) Haematology & Transfusion Medicine **e) Morbid Anatomy & Histopathology**

(1). There shall be one written paper (100 marks) of the subject of specialization (Paper V) of three hours duration at the end of second academic year.

(2). The Practical and Viva Voce examination of specialized subject will be of 100 marks.

	THEORY			PRACTICAL & ORAL		
	MCQs (45)	SEQs (9 out of 9)	Internal Assessment	Internal Examiner	External Examiner	Internal Assessment
PAPER V	45	45	10	45	45	10

(2). THESIS AND VIVA EXAMINATION – 200 Marks.

UNIVERSITY OF HEALTH SCIENCES, LAHORE

STATUTES & REGULATIONS FOR M.Sc MEDICAL TECHNOLOGY

STATUTES:

1. The Outline of Examination with marks allotted to each subject are given in Appendix "A" and the Syllabi and Courses of Studies of each subject, are given in Appendix "B".
2. The Outline of Tests and the Syllabi and Courses of Studies can be modified from time to time by the Academic Council with the approval of the Syndicate and the Regulations by Board of Governors.
3. The duration of the course shall be of two years.
4. The admission of M.Sc Medical Technology shall be carried out in the prescribed manner under the supervision of the Admission Committee.
5. There shall be four courses (Morbid Anatomy & Histopathology, Microbiology & Immunology, Haematology & Transfusion Medicine and Chemical Pathology) during first academic year.
6. There shall be a Specialized Course in area of specialization during the second academic year opted by the candidate from four subjects(Morbid Anatomy, Microbiology/Immunology, Haematology & Transfusion medicine and Chemical Pathology)
7. The research work and thesis writing in area of specialization will be completed during 2nd academic year.
8. The examination of the subjects and practical & oral Examination will be held at the end of first academic year.
   a) Paper I - Morbid Anatomy & Histopathology
   b) Paper II - Microbiology & Immunology
   c) Paper III - Haematology & Transfusion Medicine
   d) Paper IV - Chemical Pathology

   Candidate will choose one of the following subjects as their area of specialization:
   a) Chemical Pathology b) Microbiology c) Immunology
   d) Haematology & Transfusion Medicine
   e) Morbid Anatomy & Histopathology
9. The examination of the specialized course shall be at the end of second academic year.
10. The thesis examination will be at the end of second academic year.
11. The candidate shall be eligible to take examination if he/she has registered himself/herself as a student of M.Sc Medical Technology in accordance with the admission regulations and fulfills the requirements of attendance and course work.

12. The degree of M.Sc Medical Technology shall be conferred on a person who holds B.Sc Medical Lab Technology/ B.Sc (Hons) in Chemistry/Biology/Biotechnology/MBBS degree and passed his M.Sc Medical Technology course and thesis examinations.
13. The practical examination shall be conducted by one external examiner and one internal examiner.
14. The thesis shall be evaluated by two external examiners from other universities / medical colleges from within the country.
15. Provided that there is nothing contrary to the rules and regulations as laid down by the University for the M.Sc Medical Technology Examination in the relevant field, a candidate may submit his/her thesis for the award of M.Sc Medical Technology degree after meeting the following requirements:
    (i) The research work was carried out in accordance with the relevant rules and regulations of the University.
    (ii) The candidate submits the thesis through the supervisor.

REGULATIONS:

1. GENERAL REGUALTIONS

(i) The academic requirements for the M.Sc Medical Technology degree shall comprise course work, lab work and a thesis based on research.
(ii) Each M.Sc Medical Technology student shall follow the Syllabi and Courses of Studies as may be prescribed by the Academic Council from time to time with the approval of the Syndicate.
(iii) The courses shall be completed by the end of the first academic year and the specialized course in the area of specialization, as well as the research work and thesis shall be completed during the second academic year.
(iv) M.Sc Medical Technology students shall be required to pay tuition fee and such other dues as may be determined by the University from time to time.
(v) The candidate shall be awarded the degree of M.Sc Medical Technology in the area of specialization after successful completion of all courses of study, qualifying all examinations and fulfilling all other requirements of the degree (research work & thesis).

2. REGULATIONS FOR ADMISSION

(i) All the admission process will be coordinated and organized by the Department of Medical Education, UHS.
(ii) There shall be an admission committee to supervise admissions.
(iii) Admissions shall be made on the basis of merit in accordance with the criteria laid down by admission committee.
For admission, a student must have first or upper 2nd division in:

- B.Sc. Medical Laboratory Technology
- B.Sc (Hons) Chemistry/Biology/Biotechnology
- M.B.B.S
- Entry Test and Interview

A detailed CV along with 2 letters of references must be submitted with the application form. Applicants with experience will be preferred.

(iv) The Vice Chancellor shall finally approve the admissions only in the light of recommendations made by the admission committee.

(v) To be eligible for admission to M.Sc Medical Technology, a candidate shall possess an B.Sc Medical Lab Technology/ B.Sc (Hons) in Chemistry/Biology/Biotechnology / MBBS degree or any other degree recognized by the University as equivalent to aforementioned degrees.

(vi) The number of students each year for admission in shall be decided by a committee comprising the Vice Chancellor (Chairperson), Director Medical Education and Head of the Department of Allied Health Sciences (DAHS).

(vii) The Head of the Department, each year, shall communicate for approval of the Admission Committee prior to the admissions, the total number of seats for students to be admitted. This number shall not be increased without the prior approval of the Department of Medical Education and the Vice Chancellor.

(viii) Each candidate shall submit application for admission in response to advertisement, on a prescribed form along with documents specified in the admission form.

(ix) A candidate who is in Government service will apply through proper channel and will submit the deputation letter by the authorities concerned.

(x) All the candidates shall have to undertake a bond at the time of registration.

(xi) Students dropped or struck off the rolls of the University due to shortage of lectures or poor performance or non appearance in examination or non-payment of dues or on disciplinary grounds etc, shall not be granted re-admission.

(xii) Any student, who was rusticated, expelled or whose entry in the University Campus was banned for any reason whatsoever, shall not be re-admitted.

(xiii) The following shall not be eligible for admission:

a. Anyone who has been rusticated or expelled by any University or College for misconduct or use of unfair means in the examinations or any offence involving moral turpitude.
b. Any one who was admitted earlier to M.Sc Medical Technology program but later was declared to have ceased to be a student of the University under the prescribed regulations.

(xiv) All admissions made in contravention of these Regulations shall be void.

3. REGULATIONS FOR REGISTRATION

Student of M.Sc Medical Technology shall have to register for the specialized courses of study in the prescribed manner at the end of first academic year.

4. REGULATIONS FOR STUDIES AND EXAMINATIONS

(i) The students of M.Sc Medical Technology shall be assessed monthly for their performance in academic activities, punctuality and discipline. Monthly report of each student shall be submitted by the Head of the Department to Vice Chancellor and Director Medical Education.

(ii) Any student who fails to achieve satisfactory assessment report will be given warning and his case will be referred to Director Medical Education for further necessary action.

(iii) The M.Sc Medical Technology examination shall be based on MCQ & SEQ pattern. The MCQ paper will have the format of single best answer. A candidate shall be declared to have passed the examination if he/she obtains a minimum of **60%** of the total marks in Theory (in aggregate of MCQ paper, SEQ paper and internal assessment). A minimum of **60%** marks (in aggregate) shall also be required to pass the practical, viva-voce examination and internal assessment.

(iv) A student shall be allowed to appear in the examination, provided he/she has been registered by the University during the session and has attended at least 75% of the lectures/laboratory work and completed the course work to the satisfaction of the department.

(v) All the Examination of M.Sc Medical Technology shall be held twice a year (Annual & Supplementary) as prescribed. The thesis has to be submitted within six months of completion of second academic year.

(vi) The candidates securing 80% marks or above shall be deemed to have passed with distinction, provided he/she has passed the examination in first attempt.

(vii) The candidate shall have to pass the examination in a maximum of three attempts to enable him/her to continue his/her studies of second academic year.

(viii) A student who fails even after availing **three** chances shall cease to be a student of the University and shall not be eligible for another attempt.

(ix) If a candidate fails in any of the subjects, he will reappear only in that subject in supplementary examination. If a candidate passes in theory but fails in practical/oral, he will appear only in practical/oral but if a candidate fails in theory but passes in practical/oral, he will appear both in theory and in practical/oral.

(x) A student obtaining first position in a course shall be awarded a 'Certificate of Merit' provided that he/she obtains a total of at least 75% marks and has passed all the examinations in first attempt and has completed the entire requirements for M.Sc Medical Technology degree within two years.

5. REGULATION FOR THE APPOINTEMENT OF EXAMINERS IN THEORY

(i) Board of Studies of Allied Health Sciences shall recommend a panel of internal and external examiners in the subject concerned and forward it to Advanced Studies & Research Board for approval.

(ii) The Vice Chancellor shall appoint initial and final paper setters and external examiners in theory from the panel.

(iii) The Vice Chancellor shall also appoint internal and one/two external examiners for practical and viva-voce examination from the panel approved by the Advanced Studies & Research Board.

(iv) The external examiner shall be a medical teacher in any University within Pakistan or a college affiliated with the University or any other recognized academic institution.

(v) No person shall be appointed as examiner who has near relation i.e., father, mother, full and half brother and sister, paternal and maternal uncle, father-in-law, mother-in-law, brother-in-law, sister-in-law, son-in-law, daughter-in-law, wife, son, daughter or husband appearing in the paper to be set or examined by him/her.

(vi) A question paper will be set by the external examiner on MCQ and SEQ pattern from the Bank developed by the UHS.

(vii) The SEQ papers shall be marked by external examiners only.

(viii) The date sheet to hold the examination shall be notified by the Controller of Examinations in consultation with the Head of Department and approved by the Vice Chancellor.

(ix) The award list of the practical examination shall be submitted jointly to the Controller of Examinations by both internal and external examiners.

(x) The Controller of Examinations shall compile and declare the results on the basis of evaluation record in theory and practical examinations submitted by the examiners strictly in accordance with the regulations.

6. RESEARCH WORK & APPOINTMENT OF SUPERVISOR

(i) A student shall select a topic of thesis which will be recommended by the supervisor by the end of 1st academic year of studies for approval of the Advanced Studies & Research Board.

(ii) Each student shall perform research work in partial fulfillment of the requirements of the degree under the supervisor appointed for the purpose by the Advanced Studies and Research Board.

(iii) The research supervisor must hold a postgraduate degree which shall not be less than M.Sc Medical Technology/M.Phil in the relevant subject with sufficient experience.

(iv) Whenever necessary, a co-supervisor may also be appointed with postgraduate qualifications in the related field.

(v) In case a student fails to complete the research and thesis requirements of M.Sc Medical Technology during the period of second

academic year, provided that he has passed his 1st year and 2nd year examinations successfully, an extension of specified time may be granted on the recommendation of the supervisor.

(vi) No extension beyond 12 months shall be granted under any circumstances. A student failing to submit his/her thesis by the end of the 3rd year shall cease to be a student of the University. He/She shall not be allowed any other chance.

(vii) The student is required to submit 4 copies of thesis to the Controller of Examinations within the prescribed time limit.

(viii) The thesis shall be printed on A4 size paper and initially be submitted in ring bound for along with soft copy on CD and finally be submitted as black hard binding with golden lettering on the front and the spine in prescribed manner.

(ix) A copy of the thesis shall be sent to the library by the Controller of Examinations after successful completion of the requirements of the M.Sc Medical Technology degree by the candidate.

7. REGULATIONS FOR THESIS EXAMINATION

a) A student shall be eligible for M.Sc Medical Technology thesis examination provided:

   i. that he/she has been a student on a regular basis for the prescribed period, or allowed necessary extension as provided under Clause 6 (v).

   ii. that he/she has successfully completed and passed 1st year and 2nd year examination of the prescribed courses, including seminars, and tutorials to the satisfaction of the supervisor and the Head of the Department.

   iii. that he/she completed a thesis on the basis of a research topic approved by the Advanced Studies and Research Board.

b) That after completion of the requirements stated above, the student shall submit an application on a prescribed form to the Controller of Examinations for admission to the thesis examination for M.Sc Medical Technology.

c) The Vice Chancellor shall appoint two external examiners for the thesis examinations out of the panel approved by Advanced Studies & Research Board from within the country excluding UHS.

d) The thesis shall be sent for evaluation to the external examiners, well in time before the date of viva-voce examination.

e) After the approval of thesis by the evaluator, the thesis viva-voce examination shall be held within the University Campus on such date as may be notified by the Controller of Examinations. The Controller of Examinations shall make appropriate arrangement for the conduct of thesis/oral examination in consultation with the department and external examiners.

f) The thesis viva-voce examination shall be conducted by two External Examiner who shall submit a report on the suitability of the candidate for the award of degree. The supervisor shall act as coordinator.

8. STUDENTS DISCIPLINE

(i) The Progress report of each student of M.Sc Medical Technology shall be prepared that will contain academic progress, attendance and behavior. Progress report will be submitted to the Vice Chancellor and Director Medical Education.

(ii) All the students shall abide by the Rules, Regulations and Statutes of the University and follow all directives issued from time to time.

(iii) No student shall undertake any employment during the course of study. Each student admitted to the course will be paid a stipend of Rs. ten thousand (10,000/-) per month. The students will not be permitted to work anywhere and they will submit an affidavit to this effect. Defaulters will have to return the whole stipend besides facing termination.

(iv) No students shall, through document or by any communication, approach the press in his own name or through an association. No student shall take part in political activities or form union, association or any other

(v) Violation of these rules shall entail rustication/expulsion under the provisions of the University Ordinance.

9. FEE & OTHER DUES

Each student shall be required to pay registration and tuition fees, examination fee and such other charges as may be prescribed by the University from time to time.

Appendix 'A'

M. Sc MEDICAL TECHNOLOGY EXAMINATION

OUTLINE OF EXAMINATION PAPERS

EXAMINATION AT THE END OF 1st YEAR

There shall be four written papers at the end of 1st academic year.

(i) The written paper of each subject shall be of 100 marks based on 45 MCQs (45 marks) and 9 SEQs (45 marks) with no choice, of three hours duration and 10 marks for internal assessment.

Paper I Morbid Anatomy & Histopathology
Paper II Microbiology/Immunology
Paper III Haematology & Transfusion Medicine
Paper IV Chemical Pathology

(ii) The Practical and Viva Voce examination of each subject will be of 100 marks.

	THEORY			PRACTICAL & ORAL		
	MCQs (45)	SEQs (9 out of 9)	Internal Assessment	Internal Examiner	External Examiner	Internal Assessment
PAPER I	45	45	10	45	45	10
PAPER II	45	45	10	45	45	10
PAPER III	45	45	10	45	45	10
PAPER IV	45	45	10	45	45	10

(2) EXAMINATION AT THE END OF 2nd YEAR

The area of specialization can be chosen from the following

a) Chemical Pathology **b) Microbiology** **c) Immunology**
d) Haematology & Transfusion Medicine **e) Morbid Anatomy & Histopathology**

(1). There shall be one written paper (100 marks) of the subject of specialization (Paper V) of three hours duration at the end of second academic year.

(2). The Practical and Viva Voce examination of specialized subject will be of 100 marks.

	THEORY			PRACTICAL & ORAL		
	MCQs (45)	SEQs (9 out of 9)	Internal Assessment	Internal Examiner	External Examiner	Internal Assessment
PAPER V	45	45	10	45	45	10

(2). THESIS AND VIVA EXAMINATION – 200 Marks.

NOTE:

A candidate shall be declared to have passed the examination if he/she obtains a minimum of **60%** of the total marks in Theory (in aggregate of MCQ paper, SEQ paper and internal assessment). A minimum of **60%** marks (in aggregate) shall also be required to pass the practical, viva-voce examination and internal assessment.

Appendix 'B'

SYLLABI AND COURSES

Syllabus For Morbid Anatomy And Histopathology

Introduction to Microscopy:

Brief history of microscopy Relationship of microscopy anatomy to other fields of medicine, object and scope of the present course.

Theory of the Light Microscope:

Nature of light, Concepts of amplitude, Wavelength and Phase. Perception of color and brightness. Refraction, formation of images. Simple and Compound microscope.

Lenses of The Microscope:

Merits and Demerits of achromatic and apochromatic objectives. Immersion objectives. Specification of objective magnification, focal length, tube length, resolution, numerical aperture etc. Calculation of the resolution and magnification. Eye pieces, magnification of eye pieces use of eye piece micrometer. Condensers, correct use of condenser and the iris diaphragm.

Microscope Illumination:

Use of illuminators. Alignment of illuminator with the microscope. Setting up kaoeheler illumination setting up dark field illumination.

Care and Cleaning of the Microscope:

Care of the mechanical parts. Care of the Optical parts. Techniques of cleaning the optical components.

Introduction to common Histological Techniques:

Examination of fresh material. Supravital staining. Examination of fixed material.

Fixation:

The purpose of fixation, common fixative used for the histological techniques.

The Paraffin method of Sectioning Tissue:

Advantages and disadvantages of the paraffin method. Dehydration of tissues. Clearing of tissues impregnation with paraffin. Paraffin block making. Section cutting with a rotary microtome. Fixing paraffin section to slides.

Care of Microtome and Microtome Knives:

Grinding and stooping of microtome knives. Cleaning and lubrication of the microtome.

The Freezing Method of Sectioning:

Advantages and disadvantages of freezing method. Common techniques of freezing tissues. Cutting sections with a freezing microtome.

Stains:

Object of staining. Classification of stains. Acids and basic dyes. Basophilic and acidophilic tissue components.

Routine Haematoxyline-Eosin Staining Of Paraffin Sections:

The procedure of haematoxyline-eosin staining and mounting sections. The relation of various steps in this procedure.

SPECIAL STAINING TECHNIQUES

Stains for Connective Tissue Elements:

Mallory's connective tissue stain
Aldehyde fuchsine stain for elastic fibers.
Toluidine blue staining of mast cells.

Stains for Nervous Tissues:

Nissel Stain. Stains for myelin.

Histochemical demonstration of lipids:

Choice of fixative. Choice of sectioning Technique. Sudan Black B Stain. Staining for frozen section.

Histochemical demonstration of glycogen:

Choice of fixative and sectioning Best's Carmine staining for paraffin sections.

The PAS Technique:

The Schiff reaction. Significance of the Schiff reaction. Procedure of the PAS staining.

Tumor Marker and Immunohistochemistry

SPECIAL GROSS ANATOMICAL TECHNIQUES

Preserving and mounting gross anatomical specimen:

Preservative fluids. Mounting specimens in fluid media. Mountings specimens in plastics.

Embalming of Cadavers:

The choice of embalming fluid. Techniques of perfusion. Storing embalmed cadavers.

ELEMENTARY HISTOLOGY

Tissues of the Body:

Concept of the tissues, organs and systems built out of cells as anatomical and functional units. The four basic types of tissues. Specialized morphological and functional characteristics of
Epithelial Tissue, Connective Tissue, Muscular Tissue, Nervous Tissue.

ELEMENTARY ANATOMY.

The purpose of this part of the course is to familiarize the student with the gross component parts of the various systems of human body. Reference is made to comparative anatomy of common laboratory animals.

Introduction to Gross Anatomy:

General organization of the body.
Division into systems.
Descriptive terms used in gross anatomy.

Skeletal system:	Subdivision, recognition of individual bones.
Vascular system:	Identification of gross components; heart and recognition of its chambers; recognition of the major arteries and veins.
Respiratory system:	Recognition of larynx, trachea, main bronchi, Main pulmonary vessels and lobes of the lungs.
Digestive system:	Parts of the G.I.T; liver, spleen, pancreas their recognition and locations.
Genito-urinary system:	Parts of the male and female reproductive and urinary systems – their recognition and location.
Nervous system:	Gross components: (i) Brain: Cerebrum, brain stem and cerebellum. (ii) Spinal Cord (iii) Nerves: Cranial, spinal.
Endocrine system:	Location of the various endocrine glands and their recognition.

Not more than four MCQs and one SEQ will be from Elementary anatomy in the Morbid Anatomy & Histopathology paper.

SYLLABUS FOR MEDICAL MICROBIOLOGY

- Nature of Microorganisms
- Classification of Microbes
- Prokaryotes & Eukaryotes
- Bacterial Anatomy
- Bacterial Physiology
- Sterilization & Disinfection
- Bacterial Genetics
- Immunology/Serology
- Antimicrobial Sensitivity Testing Techniques

- **BACTERIOLOGY**
  - Staphylococci
  - Streptococci & Pneumococci
  - Neisseria
  - Corynebacteriun & Lactobacillus
  - Mycobacteria: Myco. tuberculosis, Myco. leprae
  - Actinomyces & Nocardia
  - Clostridia
  - Genus: Bacillus
  - Enterobacteriaceae
  - Vibrionaceae & Pseudomonas
  - Pasteurella group: Yersinia: Pasteurella: Francisella
  - Brucella
  - Haemophilus
  - Bordetella
  - Spirochaetes
  - Treponema: Borrelia: Leptospira
  - Chlamydia
  - Mycoplasma
  - Misc. Bacteria: Listeria, Erysepalothrix, Bacteroides, Bartonella
  - Rickettsiae
- **VIROLOGY**
  - Genital Introduction of Viruses
  - Serological Diagnosis of viruses
  - Herpes Viruses
  - Hepatitis C Virus
  - Hepatitis B Virus
  - Hepatitis A Virus
  - Rota Virus
  - HIV Virus
  - Rubella

- **PARASITOLOGY**
  - Introduction to Parasites
  - Intestinal Protozoa
  - Helminthes
  - Blood & Tissue Parasites
  - Nematodes
  - Cestodes

- **MYCOLOGY**
  - Introduction to Fungi
  - Basic Morphology of Fungi
  - Moulds: Dermatophytes
  - Yeasts
  - Dimorphic Fungi
  - Miscellaneous Fungal Infection
  - Mycetoma: Aspergillosis: Mycotoxins

- **MICROBIOLOGICAL TECHNIQUES**
  - Microscopy
  - Staining Methods
  - Culture Media & their preparation
  - Methods for Anaerobic Culture
  - Common Culture Methods
  - Serological Techniques
  - Collection, Transport & Processing of Microbiological Specimens
  - Biochemical Testing of Microorganisms
  - Microbiological Examination of Water, Milk & Food Specimens
- **IMMUNOLOGY**
  - Immunity cell mediated Humoral
  - Hypersensitivity
  - Complement system
  - Antigens
  - Antibodies
  - Various Ag , Ab reactions & their clinical applications
  - Agglutination
  - Precipitation
  - ELISA
  - RIA
  - Complement fixation
  - Immunoflourscence
  - Flowcytometry

SYLLABUS FOR THE SUBJECT OF HAEMATOLOGY AND TRANSFUSION MEDICINE

Introduction to Haematology

Review of vascular system and Blood constituents

Anatomy of Bone marrow and haematopoiesis

Blood formation in the body (Intra-uterine and extra-uterine)
Factors governing haematopoiesis
Stages of normal cell maturation

Safe methods of securing blood for analysis

Documentation of Laboratory data

Use of computer software in various sections of laboratory

Laboratory safety

Safe handling of specimens
Risk of communicable diseases such as HCV &HBV
Exposure to reagents having toxic or carcinogenic nature

Quality control in Haematology and blood bank

Internal quality control measures
External quality assessment

Anticoagulants for haematology tests

Chemical anticoagulants
Biological anticoagulants
Preparation and use of important anticoagulants
Anticoagulation in blood banking
Dilution & Defibrination

Estimation of Haemoglobin Concentration

Cynmethaemoglobin (HiCN) method
Preparation of Calibration curves
Acid haematin and alkaline haematin method
Oxyhaemoglobin method
Other methods of haemoglobinometery

Enumeration of Erythrocytes

General Principles of RBC count.
The hemocytometer, red cell pipette and diluting fluids
Normal Values in different age groups.

Haematocrit

Definition and principle of test procedures:
Correlation of haemoglobin, haematocrit, and erythrocyte count.

Erythrocyte Sedimentation Rate

Principle and kinds of test procedures
Normal values.
Significance of Abnormal Values.

Preparation of Blood Smears.

Preparation, drying & staining of smears

Types of Stains.
Criteria for good smear
Variation in haemoglobin content and staining properties

Examination of stained smears:

Define differential count.
Observation of erythrocytes
Number of Platelet estimated.
Tabulation of Leukocytes.
Classification of leukocytes and normal ranges

The Red Cell indices.

Mean Corpuscular Volume (MCV)
Mean Corpuscular Haemoglobin (MVH)
Mean Corpuscular Haemoglobin Concentration (MCHC)

Reticulocyte Count:

Normal values for adults and infants.
Means of demonstrating reticulocytes, Principle of the staining reaction:
Interpretation of findings & sources of error

Investigations for Haemoglobinopathies

Haemoglobin Electrophoresis
Estimation of Hb A2
Estimation of Hb F
Demonstration of Hb H inclusions
Detection of sickle haemoglobinopathies
Demonstration of Heinz bodies
Heat instability test
Isopropanol precpitation test

Investigations for Membranopahties

Osmotic fragility test
Autohaemolysis test
Sucrose lysis test
Ham's test

Investigations for Enzymopahties

Glucose –6-Phosphate dehydrogenase deficiency
Pyruvate Kinase Deficiency

Tests to evaluate the haematostatic status

Hess test
Bleeding time by Duke's and Ivy's method
Whole blood clotting time
Prothrombin time (PT)
Partial thrombolastin time (PTTK)
Thrombin time
Mixing studies
Measurement of FDP
Protein C & S Estimation

Platelet Function studies

Aggregation patterns by ADP, Collagen, Adrenaline,
Restocitin and Arachidonic acid

Thrombophilia

Lupus anticoagulant screening
Platelet neutralization test

L.E Phenomenon and techniques of development of L.E cells.

Bone Marrow Aspiration

Equipment required for the process
Preparation of smears
Processing & staining of bone marrow smears
Bone marrow differential count.

Bone marrow trephine biopsy

Bone marrow trephine needles
Preservation of the marrow tissue

Special stains in Haematology:

Leucocyte Alkaline Phosphatase (LAP)
Sudan Black staining (SBB)
Peroxidase stain
Estrases
Prussian blue reaction

BLOOD BANKING

History of Blood Transfusion

Classification of Antibodies:

Precipitin
Lysin
Agglutinin
Complete/incomplete antibodies

Antigen antibody reactions

Agglutination
Haemolysis
Complement fixation

Requirements of a standard blood bank

Area
Staff
Equipments
Reagents

Blood donation

Reception of donors
Donor selection criteria
Collection & storage of blood
Screening of Blood

Blood groups ABO systems:

Techniques for blood grouping slide/ tube.
Techniques for reverse blood-grouping

Rh Typing: Agglutiongen Agglutinin theory:

Cause of sensitization to the Rh factor

Techniques for Rh factor
Sources of error

Cross Matching Procedures:

Purpose of cross match
Methods of cross matching

Cross matching problems

Rouleaux
Cold Agglutinins
Hyperproteinemia and hyperglobulinemia

Other Blood group systems

Investigations for suspected transfusion reaction

Antiglobulin tests:

Direct Coomb's test
Indirect Coomb's test
Sources of error

Rh / Atypical Antibody tests:

Screening tests using a cell panel:
Slide
Tube test
Titrations

Erythoblastosis Foetalis:

Causes:
Due to Rh & ABO incompatibility
Methods of testing

Lab Diagnosis of Leukaemias, Anaemias

Syllabus For Chemical Pathology

General Laboratory Techniques and Procedures

Basic concepts in Laboratory Medicine and Ethics
Hazards in Laboratory & Safety Guidelines
Chemicals and General Laboratory Equipment.
Glassware, Pipets,
Units of Measurement
Reagent Grade Water

Specimen Collection and Processing

Phlebotomy techniques and guidelines
Collection of samples
Blood, urine faeces, body fluids and presentation, transport and storage
Processing of Samples
Factors affecting composition of body fluids

Analytical Techniques and Instrumentation

Basic Concepts, Definitions, Maintenance, and Applications of Centrifuges
Balance
Spectrophotometry
Flame Emission Spectrophotometry
Atomic Absorption Spectrophotometry
Fluorometry
Nephelometry and Turbidimetry
Electrophoresis
Chromatography/Mass Spectrometry
Immunochemical Techniques
Automation in the Clinical Laboratory

Quality Assurance and Lab Management

Basic Concepts and Definitions
Internal and External Quality Control Program
Preanalytical, Analytical and Postanalytical Errors
Identifying sources of Analytical Errors
The role of statistics in analytical work
Sources of variation in analytical work
Selection of Analytical Methods
Basic concept of Lab Management
Human Resource Management

Reference Values

Basic Concepts, clinical significance and application

Proteins

Plasma Proteins
Proteins in other body fluids
Analysis of Proteins

Clinical Enzymology

Basic Concepts, and Definitions
Analytical Enzymology
Liver, Cardiac, and Skeletal Enzymes
Biliary Tract Enzymes
Digestive Enzymes of Pancreatic Origin
Miscellaneous Enzymes

Carbohydrates

Diabetes Mellitus
Hypoglycemia
Determination of Glucose in Body Fluids
Ketone Bodies
Glycated Proteins
Glycosuria

Lipids, Lipoproteins, and Apolipoproteins

Basic Biochemistry
Clinical Significance
Measurement of Lipids, Lipoproteins, and Apolipoproteins

Electrolytes and Blood Gases

Sodium, Potassium, Chloride, Bicarbonate
Methods of determination of electrolytes
Plasma and Urine Osmolality
Sweat Testing
Blood Gases and pH

Liver Function

Clinical Manifestations of Liver Disease
Biochemical Functions of the Liver
Lab Diagnosis and Interpretation of Liver function Tests

Cardiac Markers

Basic Biochemistry and Tissue distribution
Clinical Utility of Cardiac Markers
Lab diagnosis of Myocardial Infarction

Renal Function and Nitrogen Metabolites

Diagnosis and Screening for Renal Diseases
Types of Renal Failure, The Ureamic Syndrome
Nephrotic Syndrome

Renal Function Tests
Analytical Tests and Methods
Detailed Biochemical Analysis of Urine

Gastric, Pancreatic, and Intestinal Function

Basic Anatomy, Physiology and Definitions
Gastrointestinal Hormones
Enzymes of the Gastrointestinal
Tests Measuring the Exocrine Function of the Pancreas
Pancreatic and Intestinal Diseases

Mineral and Bone Metabolism

Biochemistry / Analytical Methodology and Lab diagnosis of Calcium, Phosphate, Magnesium
Hormones Regulating Mineral Metabolism

Course for Specialized Subject

General Endocrine Function

Actions of Hormones
Regulation of Hormone Secretion
Biorhythms
Hormone Receptors

Pituitary Function Tests

Thyroid Function Tests

Hyperthyroidism
Hypothyroidism
Interpretation and Analytical Methods

Parathyroid Gland

Parathyroid Hormone (PTH) Actions
Methods of Determination of PTH

Adrenal Gland

General Steroid Chemistry
Adrenocortical Steroids
Disorders of the Adrenal Cortex
Disorders of the Adrenal Medulla
Methods for the Determination of Adrenal Steroids
Catecholamines and Metabolites

Lab Diagnosis of Male and Female Infertility

Interpretation and Analytical Methods

Lab Diagnosis of Porphyrin Disorders

Inborn Errors of Metabolism

Basic concepts, Lab diagnosis, Analytical Methods

Amino Acids

The Aminoacidurias
Analysis of Amino Acids

Tumor Markers

Introduction to Tumor Markers
Clinical Applications of Tumor Markers
Specific Tumor Markers

Therapeutic Drug Monitoring

Basic Concepts and Definitions

Clinical Toxicology

Basic Concepts
Screening Procedures for Detection of Drugs

Trace Elements

Basic Concepts and Definitions
Essential Trace Elements
Laboratory Assessment of Trace Metal Status

RECOMMENDED BOOKS FOR
M.Sc. MEDICAL TECHNOLOGY

1.	**MORBID ANATOMY & HISTOPATHOLOGY**	
	C.J. KIRK. RN. PEEL	Basic Medical Lab. Technology (Pitman
	LESSON PAPARD	Text Book of Histology (Saunders. USA
	BAILEYS HISTOLOGY. GRANTS ATLAS OF ANATOMY	
	REFERENCE BOOKS:- JOHN. D. BANCRAFT.	Theory & Practice of Histological technique (churchill, Edinburgh)
	ANDREW. W.A.D.	Text Book of Pathology. (Kimpson, London).
2	**MICROBIOLOGY INCLUDING PARASITOLOGY** Essential Reading	
	MONICA	Laboratory Manual for Tropical Countries.
	MACKIE AND MAC ARTNEY	Hand Book of Practical Bacteriology (Living Stone, Edinburgh).
	BLACK LOCK AND SOUTHWELL	Guide to Human Parasitology (H.K. Lewis & Co. London)
	MONICA	Laboratory Manual for Tropical Countries.
	MACKIE AND MAC ARTNEY	Hand Book of Practical Bacteriology (Living Stone, Edinburgh).
	BLACK LOCK AND SOUTHWELL	Guide to Human Parasitology (H.K. Lewis & Co. London)
	ZINSSER	Text Book of Microbiology
3	**HAEMATOLOGY & TRANSFUSION MEDICINE**	
	G.C. DEGRUNCHI	Clinical Haematology
	DACIE J.V.	Practical Hematology (Churchill, London)
	WHITBY & BRITTON	Disorders of the Blood (Churchill, London).
	J.W. DELANCY & G. GARRALTY	Hand book of Hematology & Blood Transfusion Technique. (Butterworths London).
	REFERENCE BOOKS:	
	WINTROBE M.M.M.	Clinical Hematology (Kingston, London).
	MORRISON	Text Book on Blood Transfusion and Grouping
	A. GOLDBERG & M.C. BRAIN.	Recent Advance in Haematology (Churchill Livingstone, London).

	EHIVTH A. KABAT	Blood Group Substance (Academic Press Ind. N.Y.)
4	**CHEMICAL PATHOLOGY**	
	KING & WOOTEN	Micro-analysis in Medical Biochemistry (Churchill, London)
	BARON	Short Text Book of Chemical Pathology (Hodder & Stoughton London)
	ZILVA	Text Book of Chemical Pathology
	MUSHTAQ AHMAD	Essential Bio-chemistry
	C.H. GRAY & J.H. HOWORTH	Clinical Chemical Pathology (Edward Arnold London.)
	REFERENCE BOOKS:	
	KOLMER	Clinical Diagnosis by Laboratory Examination (Appleton-Century Crafts Inc. New York).
	STEWART AND DUNLOP	Clinical Chemistry in practical Medicine (Livingston, Edinburgh).
	VVARLEY	Text Book & Principle of Chemical Pathology.
	NORBERT W. TEITZ	Text Book of Clinical Chemistry (Saunders Co. Philadelphia).