TEERTHANKER MAHAVEER UNIVERSITY

(Established under Govt. of U.P. Act No.30, 2008) Delhi Road, Moradabad (U.P)

Study & Evaluation Scheme
Of
Master of Science in Medical Laboratory Technology (M.Sc. MLT)

Programme: Master of Science in Medical Laboratory Technology (M.Sc.MLT)

Duration: Two year (04 Semester) full time including six months Dissertation

Medium: English

Minimum Attendance Required: 75%

Maximum Credits: 75

Minimum Credits: 75

Assessment:

	Internal	**External**	**Total**
Theory	40	60	100
Practical	50	50	100

Internal Evaluation (Theory papers):

Class Test-I	**Class Test-II**	**Class Test-III**	**Attendance**	**Assignment/ work book assignments &viva**	**Total**
Best Two out of Three CTs					
10	10	10	10	10	40

Evaluation Dissertations/Project Reports:

Internal	External	Total
100	100	200

Duration of Examinations:

Internal	External
1.5 Hrs	03Hrs

To qualify the course a student is required to secure a minimum of 45% marks in aggregate including the semester examination and teachers continuous evaluation. (i.e. both internal and external). A candidate who secures less than 45% of marks in a course shall be deemed to have failed in that course. The student should have secured at least 50% marks in aggregate to clear the semester.

Internal Practical Evaluation (50 marks)

The Internal evaluation would also be done by the Internal Examiner based on the experiment performed during the internal examination

Experiment	Attendance	Viva + Record	Total Internal
30 Marks	10 Marks	10 Marks	50 Marks

External Practical Evaluation (50 marks)

The external evaluation would also be done by the External Examiner based on the experiment performed during the external examination.

Experiment	File work	Viva	Total
			External
30 Marks	10 marks	10 Marks	50 marks

Question Paper Structure (Theory External Examination):

1. Max. Marks in each theory paper will be of 60 marks. The question paper shall consist of 6 questions. Out of which first question shall be of short answer type (not exceeding 50 words) and will be compulsory. Question No. 1 shall contain 8 parts representing all units of the syllabus and students shall have to answer any five (weightage 2 marks each).
2. Out of the remaining five questions, the long answer pattern will have internal choice with unit wise questions with internal choice in each unit. In units having numerical, weightage and information should be available both in the syllabus and the paper pattern. The weightage of Question No. 2 to 6 shall be 10 marks each.

Admission to the Next Semester: As per the university norms.

MAINTENANCE OF LOG BOOK

a. Every Post Graduate student shall maintain a record of skills he /she has acquired during the two years training period certified by the various Head of departments where he /she has under gone training including outside the institution.

b. The student should also participate in the teaching and training programs of Under Graduate students of paramedical courses, both in Theory and Practical from the first year onwards of the Post Graduate Degree course.

c. In addition the Head of the department should involve their post graduate students in Seminars, Journal clubs, group discussions and participation in work sops, CME program's national and international conferences organized by the Department, Institution and outside the institution in the state and outside the state.

d. Every Post Graduate student should be encouraged to present short title papers in conferences and improve on it and submit them for publication in indexed journals. Motivation by the Head of the Department of essential in this area to sharpen the skills of the Post Graduate students.

e. The Head of the Department should scrutinize the log book every two months and certify the work done.

f. At the end of the course the student should summarize the contents and get the log book certified by the Head of the Department and submit the log book at the time of the University Practical Examination.

Clinical Training Evaluation:

Students shall be deputed to Hematology & Clinical Pathology department wherein they shall undergo practical training of handling patients, collection and processing of blood, urine, sputum stool and body fluids samples.

Identification of patient's particulars based on CR number, Lab Number and transfer of samples from collection centers to different labs. Process of performing various tests in different labs.

Each student is required to maintain a logbook of the training. Student's performance shall be evaluated on regular basis. The faculty shall submit the assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 100.

Study & Evaluation Scheme

M.Sc. MLT (Clinical Haematology) - I Semester (I Year)

S. No.	Course Code	Subject	Period			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	MMLT-CH-101	Clinical Haematology	3	-	-	3	40	60	100
2	MMLT-CH-102	Immunohaematology & Blood Banking Techniques-I	3	-	-	3	40	60	100
3	MMLT-CH-103	Principles of Immunology	3	-	-	3	40	60	100
4	MMLT-CH-151	Practical: Clinical Haematology	-	-	2	1	50	50	100
5	MMLT-CH-152	Practical: Immunohaematology & Blood Banking Techniques-I	-	-	2	1	50	50	100
6	MMLT-CH-153	Practical: Principles of Immunology	-	-	2	1	50	50	100
7	MMLT-CH-154	Clinical Posting	-	-	18	9	50	50	100
		Total	09	00	24	21	320	380	600
Note: Two hours per week are designated for seminar and one hour per week is designated for library.									

Study & Evaluation Scheme

M.Sc. MLT (Clinical Haematology) - II Semester (I Year)

S. No.	Course Code	Subject	Period			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	MMLT-CH-201	Clinical Haematology(Non-Neoplastic)	3	-	-	3	40	60	100
2	MMLT-H-202	Immunohaematology & Blood Banking Techniques-II	3	-	-	3	40	60	100
3	MMLT-CH-203	Biostatistics & Research Methodology	2	-	-	2	40	60	100
4	MMLT-CH-204	Principles of Laboratory Management,Automation & Quality Assurance	2	-	-	2	40	60	100
5	MMLT-CH-251	Practical- Non-Neoplastic Haematology-I	-	-	2	1	50	50	100
6	MMLT-CH-252	Immunohaematology & Blood Banking Techniques-II	-	-	2	1	50	50	100
7	MMLT-CH-253	Clinical Training	-	-	18	9	50	50	100
		Total	10	00	22	21	310	390	700
Note: Three hours per week are designated for seminar and one hour per week is designated for library.									

Study & Evaluation Scheme

M.Sc. MLT (Clinical Haematology) - III Semester (II Year)

S. No.	Course Code	Subject	Period			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	MMLT-CH-301	Clinical Haematology (Neoplastic)	4	-	-	4	40	60	100
2	MMLT-CH-302	Cytogenetics & Molecular Diagnosis	4	-	-	4	40	60	100
3	MMLT-CH-303	General Pathology	2	-	-	2	40	60	100
4	MMLT-CH-351	Practical: Clinical Haematology (Neoplastic)	-	-	2	1	50	50	100
5	MMLT-CH-352	Practical: Cytogenetics & Molecular Diagnosis	-	-	2	1	50	50	100
6	MMLT-CH-353	Clinical Training	-	-	18	9	50	50	100
		Total	10	00	22	21	270	330	600
Note: Three hours per week are designated for seminar and one hour per week is designated for library.									

Study & Evaluation Scheme

M.Sc. MLT (Clinical Haematology) - IV Semester (II Year)

S. No.	Course Code	Subject	Period			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	MMLT-CH-451	Dissertation	0	0	24	12	100	100	200
	Total		00	00	24	12	100	100	200

M.Sc.MLT (Clinical Haematology)-I Semester (I Year)

L	T	P	C
3	0	2	4

Course/ Paper: Clinical Haematology

Course Code: MMLT-CH-101

Learning Objective: The curriculum of haematology aims to prepare the students in basic understanding of the composition of blood, their formation, instrumentation, techniques and methods of estimating different parameters .

Unit-I: Blood: its composition, function and formation, Hematopoiesis and hematopoietic tissue such as bone marrow, spleen, liver, thymus, lymph nodes,Red and yellow haematopoietic marrow, Mechanism of haemopoiesis, erythropoiesis, leucopoiesis (Granulopoiesis, monopoiesis, lymphopoiesis) and thrombopoiesis, role of haemopoietic growth factors, clinical use of growth factors, Anisocytosis and Poikilocytosis

Unit-II: RBC, its maturation and developmental stages, RBC membrane and its composition, RBC metabolism, red cell enzymes, role of BPG, HMP pathway, role of G-6-PD,Erythropoietin and its function

Haemoglobin , function, structure, types, variants of haemoglobin, acquired abnormal hemoglobins, Heme synthesis, Intravascular & extravascular hemolysis

Unit-III: Leucocytes, its type, morphology and function, Maturation and developmental stages of Neutrophil, Eosinophil, Basophil, Monocytes and Lymphocytes

Unit-IV: Platelets, its maturation and developmental stages, functions of platelets, structure of platelets, Primary hemostasis, role of blood vessels, Role of Patelets, Secondary hemostasis, Coagulation factors, physical & chemical properties of factors, classification of factors, coagulation cascade, coagulation inhibitory system & fibrinolysis

Unit-V: Anticoagulants, mechanism of action, advantages and disadvantages, effect of storage on blood cell, Blood collection method, Vaccutainer, its type, uses and advantages

Haemoglobin by various methods, total, absolute and differential count, general blood picture, PCV/Hematocrit, ESR, Red cell indices, Platelet count, Reticulocyte count,

Bleeding time, Clotting time, PT, APTT, Clot retraction, Protamin sulfate test,

Principles, handling, care & maintenance and applications of cell counter, Coagulometer, ESR analyzer

Learning Outcome: Students will able to collect, process and preserve the blood samples and can efficiently perform routine investigations in clinical haematology laboratory and also understand the concepts of blood formation & stages of maturation.

Suggested Readings:

1. Mukherjee .L.K(2017), Medical Laboratory Technology,Vol.1-3,3rd edition, Tata Mcgraw Hill
2. Sood Ramnik,(2015), Text book of Medical Laboratory Technology,2nd edition, Jaypee Publications
3. Wintrobe's Clinical Haematology,(2014),13th edition, Lippincott Williams & Wilkins
4. De Gruchy's Clinical Haematology in Medical Practice,(2012),Sixth edition, Wiley Publications
5. Dacie & Lewis Practical Haematology, (2011),11th edition, Elsevier Publications

M.Sc.MLT (Clinical Haematology)-I Semester (I Year)

Course/ Paper: Immunohaematology & Blood Banking Techniques-I

L	T	P	C
3	0	2	4

Course Code: MMLT-CH-102

Learning Objective: The prime concern of this subject to learn about the concept of blood grouping, blood collection, infectious markers determination, compatibility testing and quality control involved in blood transfusion services.

Unit-I

History of transfusion medicine, Basic introduction of antigen, antibody, types of antibody, naturally occurring antibodies, immune antibodies, complement, factors affecting antigen antibody reaction, introduction of monoclonal and polyclonal antibodies

Unit-II

Blood group systems, ABO & Rh system

ABO blood group system, genetics, biochemistry, secretors and non-secretors, Bombay blood group, antigen and antibody of ABO system, forward and reverse grouping, slide and tube method, descrepancies in ABO grouping and their solution

Rh blood group system, importance and genetics , Rh antigen, D^U antigen, partial D antigen, Rh antibodies and its importance Slide and tube method, Du testing, descrepancies and its solution in Rh grouping, anti-D titer

Unit-III

Other blood group system and their importance

Lewis, MNSs, KELL, DUFFY, KIDD, Lutheran etc.

Blood donor, its types, donor selection, blood collection, post donation care, adverse donor reactions, processing of donor blood, transfusion transmitted infectious markers and their identification, Preservation and storage of blood, anticoagulants, various additive system, storage during transportation

Unit-IV

Compatibility testing, major & minor cross match, Coomb's cross match, solid phase and gel technology, immediate spin technique,compatibility testing in emergencies,

Antiglobulin Test, principle, types, application, direct & indirect Coomb's test, preparation of control cells, error in Coomb's test and factors affecting Coomb's test

Unit-V

Antibody screening and identification methods, preparation and preservation of cell panels

Hemolytic disease of new born, causes, classification and laboratory investigations on new born

Learning Outcome: Students would understand the basics of transfusion medicine, laboratory testing, quality control.

Suggested Readings:

1. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications
2. Ochei J & Kolhatkar A(2000),Medical Laboratory Science: Theory & Practice, 3rd edition,Mcgraw Hill Education
3. Mukherjee .L.K(2017), Medical Laboratory Technology,Vol.1-3,3rd edition, Tata Mcgraw Hill
4. Sood Ramnik,(2015), Text book of Medical Laboratory Technology,2nd edition, Jaypee Publications
5. Wintrobe's Clinical Hematology,(2014),13th edition, Lippincott Williams & Wilkins
6. De Gruchy's Clinical Haematology in Medical Practice,(2012),Sixth edition, Wiley Publications
7. Dacie & Lewis Practical Haematology, (2011),11th edition, Elsevier Publications

M.Sc.MLT (Clinical Haematology)-I Semester (I Year)

Course/ Paper: Principles of Immunology

L	T	P	C
3	0	2	4

Course Code: MMLT-CH-103

Learning Objective: This course has been formulated to impart basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases.

Unit-I

Historical background, general concepts of the immune system, innate and adaptive immunity; active and passive immunity; primary and secondary immune response.

Hematopoeisis, T and B lymphocyte, NK cells, monocytes and macrophages,neutrophils, eosinophils, basophils, mast cells and dendritic cells, thymus and bone marrow,lymph nodes, spleen, MALT, GALT and SALT, pattern recognition receptors.
Mechanism of Inflammation & Phagocytosis

Unit-II

Antigens and haptens : Properties ,foreignness, molecular size, heterogeneity, B and T cell epitopes; T dependent and T independent antigens.

Antibodies: structure, function and properties of the antibodies, different classes, subclasses and biological activities of antibodies, isotype, allotype , hybridoma technology, monoclonal antibodies, polyclonal antibody

Unit-III

Mechanism of humoral and cell mediated immune response.

Major Histocompatibility Complex: Organization of MHC and inheritance in humans;
Antigen presenting cells, antigen processing and presentation
Complement system: Components of the complement activation classical, alternative and lectin pathways, biological consequence of complement activation, methods to study Complement fixation.

Unit-IV

Laboratory tests for demonstration of antigen – antibody reaction, affinity and avidity, cross reactivity, precipitation, agglutination, immunodiffusion, immunoelectrophoresis, ELISA

(indirect, sandwich, competitive) chemiluminescence, and ELISPOT assay, Western blotting, immunofluorescence, flow cytometry and fluorescence

Unit-V: Vaccine and its type, overview of National Immunization Course
Rheumatological diseases, etiology and pathogenesis and lab investigations
Hypersensitivity and its type
Overview of autoimmunity and autoimmune disorders
Immunodeficiency disorders

Learning Outcome: The students will learn scientific approaches/techniques that are used to investigate various diseases as well as mechanism of immune response generated.

Suggested Readings:

1. *Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.*
2. *Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition Wiley-Blackwell Scientific Publication, Oxford.*
3. *Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.*
4. *Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.*
5. *Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.*
6. *Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.*

Note: Practical Syllabus will be based on the theory paper.

MMLT-CH-151 :(Practical- Clinical Haematology)

MMLT-CH-152 :(Practical –Immunohaematology & Blood Banking Techniques-I)

MMLT-CH-153 :(Practical-Principles of Immunology)

MMLT-CH-154 :(Clinical Training)

M.Sc.MLT (Clinical Haematology)-II Semester (I Year)

Course/ Paper: Clinical Haematology (Non-Neoplastic)

L	T	P	C
3	0	2	4

Course Code: MMLT-CH-201

Learning Objective: This course has been designed to understand the blood disorders, its lab diagnosis and various type of laboratory test.

Unit-I

Complete blood count and interpretation of histograms

Disorder of Red cell-Anemia-Definition, Normal Erythrocytes kinetics and pathophysiology, various classifications of Anemia and adaptive mechanism in Anemia, Lab diagnosis of Anemia
Iron metabolism and Heme synthesis, Iron Deficiency in Anemia of chronic disorder, sideroblastic Anemia, hemochromatosis, porphyria
Megaloblastic Anemia, Pathophysiology and lab diagnosis

Unit-II
Hereditary disorders of Haemoglobin structures and synthesis.
Structural variants of haemoglobin, pathophysiology of structural haemoglobin variants, sickle cell Anemia with lab diagnosis
Thalassemia, definition, types of thalessemia including Alpha, Beta thalessemia, pathophysiology and lab diagnosis
Hemolytic Anemia-Classification, intrinsic and extrinsic, hemolytic Anemia, hereditary spherocytosis, hereditary elliptocytosis, PNH, G6PD and Pyruvate kinase deficiency, HUS, TTP, IDC
Immune hemolytic Anemia: classification ,pathophysiology and lab diagnosis

Unit-III

Disorder of White Blood Cells: Neutriophilia, Luekemoid reaction, neutropenia, morphologic abnormalities of neutrophils, functional abnormalities of neutrophils, reactive eosinophilic and hyper eosinophilic syndrome, lymphocytosis, infectious mono neucleosis, lymphocytopenia

Unit-IV

Hemostatic mechanisms and its disorders: Role of platelet in hemostasis, lab investigation of primary hemostasis
Secondary hemostasis, coagulation factors, coagulation pathways-intrinsic and extrinsic, fibrinolytic system,

Disorders of primary and secondary hemostasisVon-Wille Brand disorder, factor VIII & IX deficiency, fibrinogen deficiency, lupus like anticoagulant, thrombosis and conditions pre-disposing to thrombosis, heparin anticoagulants

Unit-V

Laboratory investigations of primary and secondary hemostasis, screening test for coagulation and fibrinolysis.

Hemoparasites and their identification: Malaria, Trypanosomes, Leishmania, Filaria

Learning Outcome: Students will learn the differential diagnosis and appropriate diagnostic evaluation of common hematologic abnormalities.

Suggested Readings:

1. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications
2. Ochei J & Kolhatkar A(2000),Medical Laboratory Science: Theory & Practice, 3rd edition,Mcgraw Hill Education
3. Mukherjee .L.K(2017), Medical Laboratory Technology,Vol.1-3,3rd edition, Tata Mcgraw Hill
4. Sood Ramnik,(2015), Text book of Medical Laboratory Technology,2nd edition, Jaypee Publications
5. Wintrobe's Clinical Hematology,(2014),13th edition, Lippincott Williams & Wilkins
6. De Gruchy's Clinical Haematology in Medical Practice,(2012),Sixth edition, Wiley Publications
7. Dacie & Lewis Practical Haematology, (2011),11th edition, Elsevier Publications

M.Sc.MLT (Clinical Haematology)-II Semester (I Year)

Course/ Paper: Immunohaematology & Blood Banking Techniques-II

L	T	P	C
3	0	2	4

Course Code: MMLT-CH-202

Learning Objective: The prime concern of this subject to learn about the concept of component preparation, apheresis, quality control and legal aspects involved in blood transfusion services.

Unit-I

Blood components, preparation of various components, principles of centrifugation,indications of various components, PRBCs, leucocyte poor RBCs, platelets concentrate, PRP, PPP, FFP, cryoprecipitate, granulocyte concentrate

Unit-II

Hemapheresis, indications of hemapheresis, apheresis machines,donor selection for apheresis, plateletpheresis and its indications, plasmapheresis and its indications

Autologous transfusion, massive transfusion, bone marrow transplantation,blood transfusion in various disorders,

Unit-III

Blood transfusion reactions and its type, prevention and control of transfusion reactions, preparation of various reagents used in blood banking

Unit-IV

Quality control in blood transfusion services, requirement of quality assurance in blood transfusion, preparation of SOPs, quality assurance in blood collection, laboratory testing, reagents, equipments, quality monitoring test, documentation & auditing

Unit-V

Legal aspects of Blood transfusion services, licensing of blood bank,legislation on blood and blood products, requirements for the functioning and operation of blood bank , Instrumentation and automation in blood bank

Learning Outcome: Students would understand and perform apheresis, component preparation, quality control and legal aspects involved in blood transfusion services.

Suggested Readings:

1. Compendium of Trasfusion medicine, Dr R N Makroo, 2nd edition
2. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications
3. Ochei J & Kolhatkar A(2000),Medical Laboratory Science: Theory & Practice, 3rd edition,Mcgraw Hill Education
4. Mukherjee .L.K(2017), Medical Laboratory Technology,Vol.1-3,3rd edition, Tata Mcgraw Hill
5. Sood Ramnik,(2015), Text book of Medical Laboratory Technology,2nd edition, Jaypee Publications
6. Wintrobe's Clinical Hematology,(2014),13th edition, Lippincott Williams & Wilkins
7. De Gruchy's Clinical Haematology in Medical Practice,(2012),Sixth edition, Wiley Publications
8. Dacie & Lewis Practical Haematology, (2011),11th edition, Elsevier Publications

M.Sc.MLT (Clinical Haematology)-II Semester (I Year)

Course/ Paper: Biostatistics and Research Methodology

L	T	P	C
2	0	0	2

Course Code: MMLT-CH-203

Learning Objective: The objective of this course is to acknowledge, appreciate and effectively incorporate the basic statistical concepts indispensable for carrying out and understanding biological hypothesis, experimentation as well as validations.

Unit-I

Research Methodology – Definition of research, Characteristics of research, Steps involved in research process, Types of Research methods and methodology, Terminology used in quality control such as sensitivity, specificity, accuracy, precision, positive and negative predictive value.

Unit-II

Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical, Measures of central tendency, Arithmetic mean, mode, median; Measures of dispersion, Range, mean deviation, variation, standard deviation, Standard error, Chi-square test

Unit-III

Introduction and significance of Student's t-distribution: test for single mean, difference of means and paired t- test, F-distribution, one-way and two-way analysis of variance (ANOVA). Small sample test based on t-test, Z- test and F test; Confidence Interval; Distribution-free test

Unit-IV

Global Perspective in the field of Clinical Laboratory Science, Development, Training, Types of Laboratory, Concept of Lab Design, Organizational Set up of NABL, CAP

Unit-V

Total Quality Management System

General Requirements for Standardization & Calibration of Clinical Laboratories: Introduction, Scope & Need of standardization, Quality Management requirement: testing & Calibration Procedures, Total Quality Assurance, Quality Control Charts & Systems.Quality Audit: Internal & External Audit, Accreditation & Certification NABL, ISO, CAP

Learning outcome: Students would be able to analyze data, applications of biostatistics in biological sciences as well as quality management system in diagnostic laboratory.

Suggested Readings:

1. CR Kothari, (2004),Research Methodology & Biostatistics,2nd edition,New Age India Publishers
2. Rao S,(2012),Introduction to Biostatistics and Research Methods,5th edition, PHI Publishers
3. Biostatistical Analysis (2012) 4th edition, J.H. Pearson Publication U.S.A.

M.Sc.MLT (Clinical Haematology)-II Semester (I Year)

Course/ Paper: Principles of Laboratory Management, Automation & Quality Assurance

Course Code: MMLT-CH-204

L	T	P	C
2	0	0	2

Learning Outcome: The students will be made aware of the basic ethics, good lab practices including awareness/ safety in a clinical lab.

Unit-I

Ethical Principles and standards for a clinical laboratory professional duty to the patient, duty to colleagues and other professionals, Good Laboratory Practice (GLP) ,Introduction to Basics of GLP and Accreditation, Aims of GLP and Accreditation, Advantages of Accreditation, Brief knowledge about National and International Agencies for clinical laboratory accreditation

Unit-II

Awareness / Safety in a clinical laboratory, General safety precautions, HIV: pre- and post-exposure guidelines, Hepatitis B & C: pre- and post-exposure guidelines, Drug Resistant Tuberculosis

Patient management for clinical samples collection, transportation and preservation, Sample accountability, Purpose of accountability, Methods of accountability

Unit-III

Sample analysis: Introduction, factors affecting sample analysis, reporting results, basic format of a test report, reported reference range, clinical alerts, abnormal results, results from referral laboratories, release of examination results, alteration in reports

Unit-IV

Quality Management system: Introduction, Quality assurance, Quality control system, Internal and External quality control, quality control chart

Biomedical

Introduction and importance of calibration and Validation of Clinical Laboratory instrument

Ethics in Medical laboratory Practice, Ethics in relation to Pre-Examination procedures, Examination procedures, reporting of results, preserving medical records

Procurement of equipment and Inventory Control,

Unit-V

Audit in a Medical Laboratory, Introduction and Importance, NABL & CAP, Responsibility, Planning, Horizontal, Vertical and Test audit, Frequency of audit, Documentation

Learning Outcome: Students would be competent enough to understand sample accountability, quality management system, biomedical waste management, calibration and validation of

clinical laboratory instruments, Laboratory Information system (LIS), Hospital Information system (HIS) and financial management.

Suggested readings:

1. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition, Elsevier Publications
2. Bishop(2013),Clinical Chemistry,7th edition, Wiley Publications
3. Henry's Clinical Diagnosis and Management by Laboratory Methods,(2011),22nd edition, Elsevier

Note: practical syllabus will be based on theory paper.

MMLT-CH-251: [Practical- Clinical Haematology (Non-Neoplastic)]

MMLT-CH-252 :(Practical –Immunohaematology & Blood banking Techniques-II)

MMLT-CH-253 :(Practical-Clinical Training)

M.Sc.MLT (Clinical Haematology)-III Semester (II Year)

Course/ Paper: Clinical Haematology (Neoplastic)

L	T	P	C
4	0	2	5

Course Code: MMLT-CH-301

Learning Objective: This paper encompasses the basic study and understanding of the various haematological disorders as well as their laboratory investigations.

Unit-I

Principles of diagnosis of hematopoietic-Lymphoid neoplasm
Classification of hematopoietic neoplasm
Classification of lymphoid neoplasm

Unit-II

Basic introduction of molecular genetics of myeloid leukemia's, CBF translocation, RAR translocation
Basic introduction molecular genetic of lymphoid leukemia's, tel gene translocation,E_2A translocation
Basic introduction molecular genetic of non-Hodgkin lymphomalignancies
Complication of hematopoietic neoplasm: host defense defect, haemorrhagic, neurologic, metabolic complication, organ infiltration, ocular, renal, anemia, abdominal, musculoskeletal complications

Unit-III

Hematopoitic growth factor, their application in hematologic neoplastic conditions
Hematopoietic stem cell transplantation and its applications,
Tumor antigens.
Cytokines, interferon, interleukins, their role in hematologic neoplastic conditions

Unit-IV

Classification of acute leukemia's
Acute lymphoblastic leukemia's, clinical features, diagnosis, classification and risk factor assessment
Acute myelogenous leukemia's, epidemiology, clinical features, immunophenotypes, classification, clinicopathologic syndromes and special types

Myelodysplastic syndromes: classification, diagnosis, clinical features, pathogenesis, biologic features and lab findings
Chronic myeloid leukemia's: history, incidence, clinical features, diagnosis, bone marrow findings, cytogenetic findings, immunophenotypes and molecular findings, cellular and molecular pathogenesis

Unit-V
Polycythemia vera: history, epidemiology, clinical feature, blood and lab findings, bone marrow study, cytogenetic and pathogenesis
Myelofibrosis: History and pathogenesis, clinical features, lab finding and diagnosis
Chronic lymphocytic leukemia: Aetiology, clinical findings, lab findings and staging
Non Hodgkin's lymphomas: aetiology, clinical features, classification and lab findings
Hodgkin Disease: Aetiology, epidemiology, clinical feature,staging and lab diagnosis
Plasma cell dyscrasis: Aetiology , protein abnormalities, clinical features and lab diagnosis
Multiple Myeloma, pathogenesis and laboratory investigations

Learning Outcome: This course made the students competent enough to understand pathogenesis of various hematological disorder and can perform various laboratory test related to them.

Suggested Readings:

1. Wintrobe's Clinical Hematology,(2014),13th edition, Lippincott Williams & Wilkins
2. De Gruchy's Clinical Haematology in Medical Practice,(2012),Sixth edition, Wiley Publications
3. Dacie & Lewis Practical hematology, (2011),11th edition, Elsevier Publications
4. R N Makroo, (2009),Compendium of Trasfusion medicine,2nd edition, Career Publications

M.Sc.MLT (Clinical Haematology)-III Semester (II Year)

Course/ Paper: Cytogenetics and Molecular Diagnosis

L	T	P	C
4	0	2	5

Course Code: MMLT-CH-302

Learning Objective: This syllabus provides a basic introduction of cytogenetic& molecular biology and various molecular diagnostic techniques.

Unit-I

Nucleic acid: Structural aspects – Components of DNA and RNA, Nucleosides & Nucleotides (introduction, structure & bonding), Double helical structure of DNA (Watson-Crick model), various forms of DNA.

RNA, types of RNA, functions

Basic introduction of replication, transcription and translation.

Unit-II

Chromosome structure and morphology, chromosomal abnormalities, numerical and structural abnormalities, cytogenetic nomenclature

Processing of specimens, Banding techniques, karyotyping, spectral karyotyping,

Unit-III

Blotting Techniques, southern blot analysis, PCR, variants of PCR, ISH, FISH

Molecular diagnosis of sickle cell anaemia,CML, AML-M3, Thalassemia

Unit-IV

Body fluids, types of body fluids, common cells in body fluids, examination of CSF, pleural,pericardial, peritoneal, synovial fluids

Bone marrow transplantation, harvesting, stem cell banking, HLA Typing & Cross matching
Bone marrow collection,processing,smear preparation and staining

Unit-V

Purification and Separation of nucleic acids , Extraction and Purification of nucleic acids, Detection and Quantitation of Nucleic acids, Gel Electrophoresis. Nucleic Acid Hybridization : Principle and application - Preparation of nucleic probes, Principle of Nucleic acid hybridization, microarrays. Western blot, ELISA

Learning Outcome: Students will also be rendered to take up future molecular biology challenges and efficiently work in diagnostic molecular setup.

Suggested Readings:

1. Wintrobe's Clinical Hematology,(2014),13th edition, Lippincott Williams & Wilkins
2. De Gruchy's Clinical Haematology in Medical Practice,(2012),Sixth edition, Wiley Publications
3. Dacie & Lewis Practical hematology, (2011),11th edition, Elsevier Publications
4. R N Makroo, (2009),Compendium of Trasfusion medicine,2nd edition, Career Publications
5. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition,Elsevier Publications
6. Henry's Clinical Diagnosis and Management by Laboratory Methods,(2011),22nd edition, Elsevier

M.Sc.MLT (Clinical Haematology)-III Semester (II Year)

Course/ Paper: General Pathology

L	T	P	C
2	0	0	2

Course Code: MMLT-CH-303

Learning Objective: The curriculum of pathology aims at preparing the students in basic understanding of diseases and their pathogenesis.

Unit-I

Cell injury and its causes, necrosis and apoptosis, Ischemic and hypoxic cell injury, atrophy, hypertrophy, hyperplasia, metaplasia

Inflammation, acute and chronic inflammation, mechanism of acute inflammation, Phagocytosis

Unit-II

Introduction of Repair and regeneration, fibrosis, wound healing

Introduction of edema, hyperemia, hemorrhage, hemostasis and thrombosis, embolism, infarction and shock

Unit-III

Introduction of neoplasia, benign and malignant neoplasms,

Brief knowledge on carcinogenesis, oncogenes and cancer, proto-oncogenes, etiology of cancer

Unit-IV

Environmental pollution, injury by chemical agents, physical agents, nutritional diseases such as PEM, Vitamins deficiency, trace elements

Unit-V

Aetiology and pathophysiology of diabetes, arteriosclerosis, myocardial infarction, respiratory diseases (COPD), Parkinson disease, Infectious diseases and their mode of transmission, TB, Dengue, Malaria, Typhoid, Chickenguniya, Swine flu, Bird flu, AIDS, Hepatitis

Learning Outcome: This curriculum will provide an introductory nature and build the concepts of how human system work in altered and diseased stage under the influence of various internal and external stimuli to the students.

Suggested Readings:

1. Harshmohan (2017), Textbook of Pathology,7th edition, Jaypee Publications
2. Robbins,(2012), Text book of Pathology, 3rd edition, Elsevier Publications

Note: Practical will be based on theory paper.

MMLT-CH-351: [Practical- Clinical Haematology (Non-Neoplastic)]

MMLT-CH-352 :(Practical – Cytogenetics and Molecular Diagnosis)

MMLT-CH-353 :(Practical-Clinical Training)

M.Sc.MLT (Clinical Haematology)-IV Semester (II Year)

Course/ Paper: Dissertation/Project

L	T	P	C
0	0	24	12

Course Code: MMLT-CH-451

The dissertation/project will be based upon the research and actual bench work. It will begin form the 3rd semester and will continue through the 4th one. The dissertation/project report will be submitted at the end of the 4th semester and evaluated by both internal as well as external examiner.