Study & Evaluation Scheme

of

Master of Science in Medical Laboratory Techniques (M.Sc. MLT)

[Applicable W.E.F. Academic Session - 2019-20 till Revised]

[As per CBCS guidelines given by UGC]

TEERTHANKER MAHAVEER UNIVERSITY

N.H.-24, Delhi Road, Moradabad, Uttar Pradesh244001

Website: www.tmu.ac.in

TEERTHANKER MAHAVEER UNIVERSITY
(Established Under Govt. of U.P. Act No. 30, 2008) Delhi Road, Bagadpur, Moradabad (U.P.)

Study & Evaluation Scheme	
SUMMARY	
Institute Name	*Teerthanker Mahaveer University, College of Paramedical Sciences, Delhi Road, Moradabad*
Programme	Master of Science in Medical Laboratory Techniques (M.Sc.MLT)
Duration	Two year (04 Semester) full time including six months Dissertation
Medium	*English*
Minimum Required Attendance	*75%*
Credits	
Total Credits	*75*

Eligibility for admissions:

A candidate seeking admission to M.Sc. MLT course must have passed bachelors degree of minimum 3 years duration in Medical lab Techniques with six months internship, recognized as equivalent by Teerthanker Mahaveer University, with not less than 50 % marks in aggregate.

Selection of eligible candidates:

Selection to the M.Sc. M.L.T., course shall be on the performance in written exam or interview conducted by Teerthanker Mahaveer University. Medical fitness certificate needs to be submitted by the candidate on the day of Admission.

Conduct and Discipline:

•	Candidates shall conduct themselves within and outside premises of the Institution in a manner defecting professional institution. As per the order of Honorable Supreme Court of India, ragging in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.
•	As per the order of Honorable Supreme Court of India, ragging in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.
•	The following acts of omission and /or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures:
•	Ragging is strictly prohibited.
•	Lack of courtesy and decorum, indecent behaviour anywhere within or outside the campus.
•	Possession, consumption or distribution of alcoholic drinks or any kind of hallucinogenic drugs.
•	Plagiarism of any nature.

Attendance and Monitoring progress of studies:

•	A candidate shall study in concerned department of the Institute for the entire period as a full time student. No candidate is permitted to work in any other laboratory/college/ hospital/pharmacy etc., while studying. No candidate should join any other course of study or appear for any other degree examination conducted by this University or any other University in India or abroad during the period of registration.
•	A candidate who has put in a minimum of 75% of attendance in theory and practical separately and who has fulfilled other requirements of the course shall be permitted to appear for University examination.
•	A candidate having shortage of attendance shall repeat the semester when it is offered next.

Dissertation work:

•	A candidate is required to carry out a research study in select area of his subject, under the supervision of a faculty guide. The results of such a study shall be submitted to the College/University in the form a dissertation as per the prescribed format and within the date stipulated by the University.
•	The dissertation work is aimed at training a postgraduate candidate in research methodology and techniques. It includes identification of the problem, formulation of a hypothesis, review of literature, getting acquainted with recent advances, designing of a research study, collection of data, critical analysis, and comparison of results and drawing conclusions.

•	Every candidate shall submit to the Department in the prescribed Performa, a synopsis containing particulars of proposed dissertation/ research project work within six to ten months from the date of commencement of the course on or before the date notified by the University. The synopsis shall be sent through the proper channel.
•	Such synopsis will be reviewed and the College will register the dissertation/ research project topic. No change in the dissertation topic/ research project or guide shall be made without prior approval of the College.
•	***Guide*:** A Guide is appointed on the basis of teaching experience. However a co-guide can be opted wherever required with prior permission of the Institute and University. The co- guide shall also be appointed on the basis of experience recognized by the University.
•	In the event of registered Guide leaving the Institute or in the event of the death of the Guide, a change of Guide shall be permitted by the University, on the specific recommendation of the Institute.
•	***Ethical clearance*:** Ethical Clearance should be obtained for a study involving any procedure on human subject. The candidate should apply for the certificate to the Ethics Committee of the Institute/University, through the Guide and present the study before the Committee for clearance. A copy of the certificate should be attached along with the synopsis forwarded at the time of submission of synopsis. All such clearance should be sought before submission of final report.
•	***Submission of synopsis:*** Synopsis should brevetted by guide, HOD and departmental curriculum development cell and approved by the institutional ethics committee before submission to the university. The synopsis should be submitted as per the format on or before one month of second semester, or within the date notified by the University, whichever is earlier. Once the synopsis is approved and registered by the university no change in the topic or Guide shall be made without the prior approval of the University.
•	***Preparation of dissertation:*** The written text of dissertation shall be as per the format, shall not exceed 100 pages (cover to cover). It should be neatly typed with 1.5 line spacing on one side of the paper (A4 size: 8.27" x 11.69") and properly bound. Spiral binding should be avoided. E-submission of the dissertation is mandatory.
•	***Final submission of the dissertation:*** The dissertation complete in all respects and duly certified by the Guide/Co-guide, Course Co-ordinator/ HOD/ Director should be submitted it to the Controller of Examinations/ College Examination Committee as per the date specified by the University, generally two month before commencement of University examinations. Plagiarism of final submitted report should be checked by University ethical and research committee.
•	The dissertation/ research project should be written under the following headings: ✓ Introduction ✓ Aims or objectives of study ✓ Review of literature ✓ Material and methods

	✓ Results ✓ Discussion ✓ Conclusion ✓ Summary ✓ References ✓ Tables ✓ Annexure

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
	Duration of Examination		**External**	**Internal**	
			3 Hours	1.5 Hours	

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.

During Semester				On the day of Examination	
Experiment	**File Work**	**Viva Voce**	**Attendance**	**Experiment**	**Viva Voce**
5 Marks	**10 Marks**	**10 Marks**	**10 Marks**	**5 Marks**	**10 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 Voce	Total Experiment
30 Marks	10Marks	10 Marks	50 Marks

Dissertation/ Project Reports Evaluation (100 marks)

The dissertation evaluated at the time of university examination of IV semester by a panel of examiner (Internal and External) appointed by the University.

Internal	External	Total
50Marks	**50 Marks**	**100 Marks**

Dissertation/ Project Reports Internal Evaluation (50 marks)

The internal dissertation evaluation would be done by the Internal Examiner based on the thesis and collected data performed during the internal examination.

Progress Report	Viva Voce	Presentation	Total
20 Marks	**10Marks**	**20 Marks**	**50 Marks**

Dissertation/ Project Reports External Evaluation (50 marks)

The external dissertation evaluation would be done by the External Examiner based on the final thesis report submitted before the external examination.

Thesis	Viva Voce	Presentation	Total
20 Marks	**10Marks**	**20 Marks**	**50 Marks**

To qualify the course a student is required to secure a minimum of 45% marks in aggregate including the semeste r examination and teacher's 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 CPI in aggregate to clear the semester.

Question Paper Structure

1	*The question paper shall consist of six questions, Out of which first question shall be of short answer type (not exceeding 50 words) and will be compulsory. Question no. 2 to 6 (from Unit-I to V) shall have explanatory answers (approximately 350 to 400 words) along with having an internal choice within each unit.*
2	*Question No. 1 shall contain 8 parts from all units of the syllabus with at least one question from each unit and students shall have to answer any five, each part will carry 2 marks.*
3	*The remaining five questions shall have internal choice within each unit; each question will carry 10 marks.*

IMPORTANT NOTES:

1	*The purpose of examination should be to assess the Course Outcomes (COs) that will ultimately lead to of attainment of Programme Specific Outcomes (PSOs). A question paper must assess the following aspects of learning: Remember, Understand, Apply, Analyze, Evaluate & Create (reference to Bloom's Taxonomy).*
2	*Case Study is essential in every question paper (wherever it is being taught as a part of pedagogy) for evaluating higher-order learning. All courses may not have case teaching method used as pedagogy.*
3	*There shall be continuous evaluation of the student and there will be a provision of fortnight progress report.*

Program Structure-M.Sc.-MLT

A. Introduction:

High-quality health care education is essential for the digital age and using technology is powerful way to enhance changing requirements of the corporate, business enterprises and society. M.Sc. is a master or post graduate degree that is - Master of Science. The specialization of Masters in Medical laboratory Techniques (also addressed as MMLT) deals with the all the laboratory techniques a health care team should know. Candidates get an opportunity to learn about the high-etch instruments related to medical science, diagnosis, treatment and even for prevention of disease.
The course includes theoretical studies, practical training and an exposure to various tests from the field of microbiology, hematology, Cytology, Biochemistry, Oncology, etc.
The course is suitable for candidates who have a research attitude and have an ability to complete the task with in time limit.

The college emphasis on courses ***balanced with core and other courses****:* The curriculum of MMLT program emphasizes an intensive, flexible education of core courses (all types). Total 75 credits are allotted for the MMLT degree.

The programme structure and credits for MMLT are finalized based on the stakeholders' requirements and general structure of the programme. However, the maximum number of the credits for award of MMLT degree will be 75 credits. Out of 29 credits of classroom contact teaching, 11 credits are to be assigned for core courses (CC), 16 credits to discipline specific course (DSC) and 2 credits are assigned to compulsory specifies course (CSC).

Course handouts for students will be provided in every course. A course handout is a thorough teaching plan of a faculty taking up a course. It is a blueprint which will guide the students about the pedagogical tools being used at different stages of the syllabus coverage and more specifically the topic-wise complete plan of discourse, that is, how the faculty members treat each and every topic from the syllabus and what they want the student to do, as an extra effort, for creating an effective learning. It may be a case study, a role-play, a classroom exercise, an assignment- home or field, or anything else which is relevant and which can enhance their learning about that particular concept or topic. Due to limited availability of time, most relevant topics will have this kind of method in course handout.

B. 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 workshop, 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.

C. 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.

D. Dissertation/Research project

Each candidate pursuing M.Sc. MLT Course is required to carry out work on selected research project under the guidance of a recognized post graduate teacher. The results of such a work shall be submitted in the form of dissertation/ research project. The dissertation/ research project is aimed to train a graduate student in research methods and techniques. It includes identification of problem, formulation of a hypothesis, search and review of literature, getting acquainted with recent advances, designing of a research study, collection of data, critical analysis, and interpretation of results and drawing conclusions. Every candidate shall submit to the Department in the prescribed Performa, a synopsis containing particulars of proposed dissertation/ research project work within six to ten months from the date of commencement of the course on or before the date notified by the University. The synopsis shall be sent through the proper channel. Such synopsis will be reviewed and the College will register the dissertation/ research project topic. No change in the dissertation topic/ research project or guide shall be made without prior approval of the College.

The dissertation/ research project should be written under the following headings:

Introduction

Aims or objectives of study

Review of literature

Material and methods

Results

Discussion

Conclusion

Summary

References

Tables

Annexure

The written text of dissertation/ research project shall not be less than 50 pages and shall not exceed 150 pages excluding references, tables, questionnaires and other annexure. It should be neatly typed in double line spacing on one side of paper (A4 size, 8.27" x 11.69") and bound properly. Spiral binding should be avoided. A declaration by the candidate for having done the work should also be included, and the guide, head of the department and head of the institution shall certify the dissertation/ research project.

Four copies of Dissertation/ research project shall be submitted to the university, through proper channel, along with a soft copy (CD).

It shall be assessed by two examiners appointed by the university, one internal and one external. If there are corrections in the dissertation / research project suggested by the examiner(s), the candidate may make such corrections and may be allowed to re-submit in time.

M.Sc.-MLT: Two Year (4-Semester) CBCS Programme			
Basic Structure: Distribution of Courses			
S.No.	**Type of Course**	**Credit Hours**	**Total Credits**
1	**Core Course (CC)**	2 Courses of 2 Credit Hrs. each (Total Credit Hrs. 2X2) 1 Course of 3 Credit Hrs. (Total Credit Hrs. 1X3) 1 Course of 4 Credit Hrs. each (Total Credit Hrs. 1X4)	4 3 4
2	**Discipline Specific Course (DSC)**	1 Course of 4 Credit Hrs. (Total Credit Hrs. 1X4) 4 Courses of 3 Credit Hrs. each (Total Credit Hrs. 4X3)	4 12
3	**Skill-Enhancement Elective Course (SEC)**	7 Courses of 1 Credit Hrs. each (Total Credit Hrs. 7X1) 3 Courses of 9 Credit Hrs. each (Total Credit Hrs.3X9) 1 Course of 12 Credit Hrs. (Total Credit Hrs.1X12)	7 27 12
4	**Compulsory Specified Course (CSC)**	1 Course of 2 Credit Hrs. (Total Credit Hrs.1X2)	2
		Total Credits	**75**

Contact hours include work related to Lecture, Tutorial and Practical (LTP), where our institution will have flexibility to decide course wise requirements.

B. Choice Based Credit System (CBCS)

Choice Based Credit System (CBCS) is a versatile and flexible option for each student to achieve his target number of credits as specified by the UGC and adopted by our University.

The following is the course module designed for the MMLT program:

Core Course (CC): Core courses of MMLT program will provide a holistic approach to health care education, giving students an overview of the field, a basis to build and specialize upon. These core courses are the strong foundation to establish health related knowledge and provide broad multi-disciplined knowledge can be studied further in depth during the elective phase.

The core courses will provide more practical-based knowledge, case-based lessons and collaborative learning models. It will train the students to analyze, decide, and lead-rather than merely know-while creating a common student experience that can foster deep understanding, develop decision-making ability and contribute to the business and community at large. College offers four core courses from I-IV semester. Each CC ranges from 2-4 credits.

Skill Enhancement Course (SEC): These courses are designed to provide value-based and/or skill-based knowledge. College offer eleven SECs from I-IV Semester. Each SEC ranges from 1-12 credits.

Compulsory Specified Course (CSC): This is a compulsory course that does not have any choice and will be of 2 credits. Each student of MMLT program has to compulsorily pass this course.

Discipline specific course (DSC): These discipline specific courses helps to enhance the knowledge of the program. College offer five DSC courses ranging from 3-4 credits.

C. Programme Specific Outcomes (PSOs)

On completion of the Programme, the student will be:

PSO1.	Understanding and remembering areas like Blood banking, Blood Sample Matching, Hematology,
PSO2.	Applying techniques for collection and preservation of biological Samples.
PSO3.	Applying the fundamentals of research process to complete and present research studies that enrich the field of physical therapy.
PSO4.	Analysing proficient operation of automated haematology instruments, including instrument maintenance and QC.
PSO5.	Evaluating the results and explaining underlying principle in each investigation.

Pedagogy & Unique practices adopted: "Pedagogy is the method and practice of teaching, especially for teaching an academic subject or theoretical concept". In addition to conventional time-tested lecture method, the institute will emphasize on experiential learning.

1. Case Based Learning: Case based learning enhances student skills at delineating the critical decision dilemmas faced by organizations, helps in applying concepts, principles and analytical skills to solve the delineated problems and develops effective templates for health related problem solving. Case method of teaching is used as a critical learning tool for effective learning and we encourage it to the fullest.

2. Role Play & Simulation: Role-play and simulation are forms of experiential learning. Learners take on different roles, assuming a profile of a character or personality, and interact and participate in diverse and complex learning settings. Role-play and simulation function as learning tools for teams and groups or individuals as they "play" online or face-to-face. They alter the power ratios in teaching and learning relationships between students and educators, as students learn through their explorations and the viewpoints of the character or personality they are articulating in the environment. This student-centered space can enable learner-oriented assessment, where the design of the task is created for active student learning. Therefore, role-play& simulation exercises such as virtual share trading, marketing simulation etc. are being promoted for the practical-based experiential learning of our students.

3. Video Based Learning (VBL) & Learning through Movies (LTM): These days technology has taken a front seat and classrooms are well equipped with equipment and gadgets. Video-based learning has become an indispensable part of learning. Similarly, students can learn various concepts through movies. In fact, many teachers give examples from movies during their discourses. Making students learn few important theoretical concepts through VBL & LTM is a good idea and method. The learning becomes really interesting and easy as videos add life to concepts and make the

learning engaging and effective. Therefore, our institute is promoting VBL & LTM, wherever possible.

4. Field / Live Projects: The students, who take up experiential projects in different hospitals/health organizations, where senior executives with a stake in teaching guide them, drive the learning. All students are encouraged to do some live project other their regular classes.

5. Industrial Visits/ Educational tour: Industrial visit are essential to give students hands-on exposure and experience of how things and processes work in education. College organizes such visits to enhance students' exposure to practical learning and work out for a report of such a visit relating to their specific topic, course or even domain.

6. Special Guest Lectures (SGL): Some topics/concepts need extra attention and efforts as they either may be high in difficulty level or requires experts from specific health organizations/domain to make things/concepts clear for a better understanding from the perspective of the health care system. Hence, to cater to the present needs of industry we organize such lectures, as part of lecture-series and invite prominent personalities from academia and health organizations from time to time to deliver their vital inputs and insights

7. Student Development Programs (SDP): Harnessing and developing the right talent for the right organizations an overall development of a student is required. Apart from the curriculum teaching various student development programs (training programs) relating to soft skills, interview skills, workshops etc. that may be required as per the need of the student and healthcare trends, are conducted across the whole program. Participation in such programs is solicited through volunteering and consensus.

8. Special assistance Programme for slow learners: Special classes are arranged for slow learners. They are assisted patiently and consistently. Motivation is one of the most essential requirements to help them continue learning. Proper acknowledgement and praise helps the overall development of such student.

9. Laboratory Focused programs: Establishing collaborations with various health partners to deliver the Programme on sharing basis. The specific courses are to be delivered by health care experts to provide practice based insight to the students.

10. Orientation program: Two week Programme is arranged to introduce students to college services which will support their educational and personal goals. To facilitate initial academic process, course selection and registration, creating an atmosphere that minimizes anxiety, promotes positive attitude and stimulates excitement for learning. It also helps knowledge of scope, information regarding academic and student service resources and Programme. It provides a welcoming atmosphere for student's to meet faculty, staff, senior students as well as other new students.

11. Mentoring scheme: The College follows the mentoring scheme. Every student is provided with a faculty mentor to help him/her in their personal & academic issues. The mentor maintains a register along with the mentor mentee booklet provided to all students. In that book all the details of student are filled and every month 2 times they meet with their mentor. Mentor fills the details of meeting in every students register and tries to solve the issue and after solving the issue the issue closed in that register.

12. Career & personal counseling: College has training and placement cell for career and personal counseling of the students.

13. Competitive exam preparation: College provides different subject experts for competitive exam preparation of students.

14. Extracurricular Activities: organizing & participation of students in extracurricular activities are mandatory to help students and develop confidence & face audience with care.

15. Participation in workshop, seminars, writing & presenting paper: College encourages students to take participate in these types of activities. Most of our students are participating in these types of activities.

16. Formation of Student clubs, membership & organizing and participating events: College have students club and students are participating in many events like youth festival and other activities those are performed in our Universities as well as in other Universities participation.

17. Capability enhancement & development scheme: College offers some schemes like soft skill development, remedial coaching, yoga and meditation and personal counseling to enhance the capability and holistic development of the students.

18. Library visit & Utilization of E-Learning resources: College as well as faculty members encourage students to go to library and study. To enhance this department have provision of Library schedule in the time table so student can use that time to refer different books and use E learn in library. College have well developed and organized library.

Study & Evaluation Scheme

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

S.N	Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	DSC-1	MMLT-CH-101	Clinical Haematology	3	-	-	3	40	60	100
2	DSC-2	MMLT-CH-102	Immunohaematology & Blood Banking Techniques-I	3	-	-	3	40	60	100
3	CC-1	MMLT-CH-103	Principles of Immunology	3	-	-	3	40	60	100
4	SEC-1	MMLT-CH-151	Practical: Clinical Haematology	-	-	2	1	50	50	100
5	SEC-2	MMLT-CH- 152	Practical: Immunohaematology & Blood Banking Techniques-I	-	-	2	1	50	50	100
6	SEC-3	MMLT-CH-153	Practical: Principles of Immunology	-	-	2	1	50	50	100
7	SEC-4	MMLT-CH-154	Clinical Posting	-	-	18	9	50	50	100
			Total	09	00	24	21	320	380	700

Note: Three hours per week are designated for seminar and one hour per week is designated for library

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

S. N	Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	DSC-3	MMLT-CH- 201	Clinical Haematology(Non-Neoplastic)	3	-	-	3	40	60	100
2	DSC-4	MMLT-CH-202	Immunohaematology & Blood Banking Techniques-II	3	-	-	3	40	60	100
3	CSC-1	MMLT-CH- 203	Biostatistics & ResearchMethodology	2	-	-	2	40	60	100
4	CC-2	MMLT-CH- 204	Principles of Laboratory Management, Automation& Quality Assurance	2	-	-	2	40	60	100
5	SEC-5	MMLT-CH- 251	Practical: Clinical Haematology(Non - Neoplastic)	-	-	2	1	50	50	100
6	SEC-6	MMLT-CH- 252	Practical : Immunohaematology &Blood Banking Techniques-II	-	-	2	1	50	50	100
7	SEC-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

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

S. N	Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	**DSC-5**	MMLT-CH-301	Clinical Haematology (Neoplastic)	4	-	-	4	40	60	100
2	**CC-3**	MMLT-CH-302	Cytogenetics & Molecular Diagnosis	4	-	-	4	40	60	100
3	**CC-4**	MMLT-CH-303	General Pathology	2	-	-	2	40	60	100
4	**SEC-8**	MMLT-CH-351	Practical: Clinical Haematology (Neoplastic)	-	-	2	1	50	50	100
5	**SEC-9**	MMLT-CH-352	Practical: Cytogenetics & Molecular Diagnosis	-	-	2	1	50	50	100
6	**SEC-10**	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

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

S. N	Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	SEC-11	MMLT-CH-451	Dissertation	0	0	24	12	50	50	100
			Total	0	0	24	12	50	50	100

Course Code: MMLT-CH-101	**Discipline Specific Course -1 (DSC-1)** **MMLT- Semester-I** **Clinical Haematology**	**L-3** **T-0** **P-2** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the concept of blood and haemopoiesis.	
CO2.	Understanding stages of cell maturation and development	
CO3.	Applying the specific technique for sample collection, its preservation & biomedical waste management.	
CO4.	Applying various methods for haemoglobin estimation.	
CO5.	Applying different test for determination of bleeding time and clot retraction.	
Course Content:		
Unit-1:	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	**8 Hours**
Unit-2:	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	**7 Hours**
Unit-3:	Leucocytes, its type, morphology and function, Maturation and developmental stages of Neutrophil, Eosinophil, Basophil, Monocytes and Lymphocytes	**6 Hours**
Unit-4:	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	**8 Hours**

Unit-5:	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	**7Hours**
Text Books:	1. *Sood Ramnik,(2015), Text book of Medical Laboratory Technology,2nd edition, Jaypee Publications* 2. *Wintrobe's Clinical Haematology,(2014),13th edition, Lippincott Williams & Wilkins*	
Reference Books:	1. ***Practical Haematology,Dacie & Lewis, 11th edition*** 2. ***De gruchy's Clinical Hematology in Medical Practice*** 1. ***https://www.hematology.org/education*** 2. ***https://www.vet.cornell.edu/animal-health-diagnostic-center/laboratories/clinical-pathology***	

Course Code: MMLT-CH-102	**Discipline Specific Course -2 (DSC-2)** **MMLT- Semester-I** **Immunohaematology & Blood Banking Techniques-I**	**L-3** **T-0** **P-2** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the concepts of antigen and antibodies	
CO2.	Understanding the concepts of blood grouping and blood collection	
CO3.	Applying different methods of quality control involved in blood transfusion services.	
CO4.	Analyzing laboratory investigations of new born	
CO5.	Evaluating compatibility testing and different transfusion transmitted infectious markers	
Course Content:		
Unit-1:	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	**8 Hours**
Unit-2:	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 .	**7 Hours**
Unit-3:	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	**6 Hours**

Unit-4:	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	**8 Hours**

Unit-5:	Antibody screening and identification methods, preparation and preservation of cell panels Hemolytic disease of new born, causes, classification and laboratory investigations on new born	**7Hours**
Text Books:	1. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications	
Reference Books:	***1. Practical Biochemistry, Singh & Sahni*** ***2. Biochemistry, Voet & Voet, 4th edition, John Wiley & sons*** ***3. Biochemistry, U Satyanarayan*** ***1. https://www.elsevier.com/books/essentials-of-medical-biochemistry/bhagavan/978-0-12-416687-5*** ***2. https://iubmb.onlinelibrary.wiley.com/journal/15393429***	

Course Code: MMLT-CH-103	**Core Course -1 (CC-1)** **MMLT- Semester-I** **Principles of Immunology**	**L-3 T-0 P-2 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basic aspects of immunity, antigens and antibody.	
CO2.	Understanding the concept of MHC	
CO3.	Applying various serological techniques and their utility in laboratory diagnosis of human diseases.	
CO4.	Analyzing various serological reactions	
CO5.	Evaluating laboratory tests for of antigen – antibody reaction,	
Course Content:		
Unit-1:	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	**8 Hours**
Unit-2:	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	**7 Hours**
Unit-3:	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.	**6 Hours**

Unit-4:	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	**8 Hours**
Unit-5:	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	**7Hours**
Text Books:	1. *Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.* 2. *Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.* ,	
Reference Books:	***1. Park & Park, Preventive & Social Medicine*** ***2. https://www.hindawi.com/journals/apm/contents/***	

Note: Course Outcomes of following practical's are covered in their respective theory courses

Course Code: MMLT-CH-151	**Skill Enhancement Course-1 (SEC-1) MMLT- Semester-I** **Practical: Clinical Haematology**	**P-2 C-1**
Course Content:		
1.	Blood collection, anticoagulants used in haematology	
2.	ESR, PCV, platelet count, absolute eosinophil count	
3.	Stains used in haematology preparation of blood film	
4.	Coomb's test	

Course Code: **MMLT-CH-152**	**Skill Enhancement Course-2 (SEC-2) MMLT- Semester-I** **Practical: Immunohaematology & Blood Banking Techniques-I**	**P-2 C-1**
Course Content:		
1.	Blood grouping- ABO grouping, forward grouping (slide and tube method)	
2.	Rh grouping and Rh typing	
3.	Compatibility testing: Cross matching techniques	
4.	Investigation of blood transfusion reactions	

Course Code: **MMLT-CH-153**	**Skill Enhancement Course-3 (SEC-3)** **MMLT- Semester-I** **Practical: Principles of Immunology**	**P-2** **C-1**
Course Content:		
1.	Serological test (screening and diagnostics) used in different pathological conditions	
2.	Delayed type hypersensitivity testing	
3.	Histocompatibility testing	
4.	ABO antibody titration	

Course Code: **MMLT-CH-154**	**Skill Enhancement Course -4 (SEC-4)** **MMLT- Semester-I** **Clinical Training**
	Students shall be deputed to various labs of 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 various posting. Student's performance shall be evaluated on continuous basis by the faculty posted in various sections.

Course Code: MMLT-CH-201	**Discipline Specific Course -3 (DSC-3)** **MMLT- Semester-II** **Clinical Haematology(Non-Neoplastic)**	**L-3** **T-0** **P-2** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1	Understanding hereditary disorders of haemoglobin	
CO2.	Applying various techniques for diagnosis of anemia	
CO3.	Analyzing hereditary disorders of Haemoglobin	
CO4.	Analyzing hemoparasites and their identification	
CO5.	Evaluating common hematologic abnormalities.	
Course Content:		
Unit-1:	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	**8 Hours**
Unit-2:	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	**7 Hours**
Unit-3:	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	**6 Hours**
Unit-4:	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,	**8 Hours**

	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-5:	Laboratory investigations of primary and secondary hemostasis, screening test for coagulation and fibrinolysis. Hemoparasites and their identification: Malaria, Trypanosomes, Leishmania, Filaria	**7Hours**
Text Books:	1. ***Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications***	
Reference Books:	1. ***Practical Haematology, Dacie & Lewis, 11th edition*** 2. ***https://www.emjreviews.com/innovations/article/e-learning-in-pathology-education-a-narrative-review-and-personal-perspective***	

Course Code: MMLT-CH-202	**Discipline Specific Course -4 (DSC-4)** **MMLT- Semester-II** **Immunohaematology & Blood Banking Techniques-II**	**L-3** **T-0** **P-2** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Applying various methods for preparation of reagents used in blood banking	
CO2.	Applying techniques for apherisis	
CO3.	Applying SOPs for quality monitoring test, documentation & auditing	
CO4.	Analyzing blood transfusion techniques and its types	
CO5.	Evaluating the legal aspects for operation of blood bank	
Course Content:		
Unit-1:	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	**8 Hours**
Unit-2:	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,	**7 Hours**
Unit-3:	Blood transfusion reactions and its type, prevention and control of transfusion reactions, preparation of various reagents used in blood banking	**6 Hours**
Unit-4:	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	**8 Hours**
Unit-5:	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	**7Hours**
Text Books:	***1. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications***	

Reference Books:	***https://www.sciencedirect.com/book/9780702051401/clinical-biochemistry-metabolic-and-clinical-aspects***	

Course Code: MMLT-CH-203	**Compulsory Specified Course -1 (CSC -1)** **MMLT- Semester- II** **Biostatics & Research Methodology**	**L-2** **T-0** **P-0** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding research methodology and basic statistical concepts	
CO2.	Applying perspectives for training development related to organizational setups	
CO3.	Applying statistical methods for representation of data	
CO4.	Analyzing data on the basis of different statistical methods	
	Evaluating data on the basis of statistical analysis	
CO5.	Evaluating quality management system in diagnostic laboratory	
Course Content:		
Unit-1:	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.	**6 Hours**
Unit-2:	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	**6 Hours**
Unit-3:	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	**7 Hours**
Unit-4:	Global Perspective in the field of Clinical Laboratory Science, Development, Training, Types of Laboratory, Concept of Lab Design, Organizational Set up of NABL, CAP	**6 Hours**
Unit-5:	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	**7 Hours**

Text Books:	1. *Research Methodology & Biostatistics by CR Kothari* 2. *Research Methodology & Biostatistics by Vinod Kumar Bais*	
Reference Books:	1. *Biostatistical Analysis (2012) 4th ed., Zar, J.H. Pearson Publication U.S.A.* 2. *https://elearningbiostatistics.com/* 3. *https://www.who.int/ihr/lyon/surveillance/biostatistics/en/*	

Course Code: MMLT-CH-204	**Core Course – 2(CC- 2)** **MMLT- Semester-II** **Principles of Laboratory Management Automation & Quality Assurance**	**L-2 T-0 P-0 C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding ethical principles and accreditation for clinical laboratories	
CO2	Applying all general & clinical safety measures to reduce the risk of infection.	
CO3.	Applying methods for interpretation and release of examination results for quality assurance	
CO4.	Evaluating the validating, instrument calibration & importance of medical audit (NABL) to enhance the quality of laboratory.	
CO5.	Evaluating pre & post exposure guidelines of some infectious diseases	
Course Content:		
Unit-1:	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	**8 Hours**
Unit-2:	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	**7 Hours**
Unit-3:	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	**6 Hours**

Unit-4:	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	**8 Hours**
Unit-5:	Audit in a Medical Laboratory, Introduction and Importance, NABL & CAP, Responsibility, Planning, Horizontal, Vertical and Test audit, Frequency of audit, Documentation	**7Hours**
Text Books:	***1. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition, Elsevier Publications***	
Reference Books:	***1. Peter Norton_s, Introductions to Computers, Tata McGraw Hill.*** ***2. Price Michael, Office in Easy Steps, TMH Publication.***	

Note: Course Outcomes of following practical's are covered in their respective theory courses

Course Code: **MMLT-CH-251**	**Skill Enhancement Course -5 (SEC-5)** **MMLT-Semester II** **Practical: Clinical Haematology (Non-Neoplastic)**	**P-2** **C-1**
Course Content:		
1.	Automation in haematology	
2.	Cytochemistry of leukemic cells	
3.	Investigation of thrombotic tendency	
4.	Hemostasis and its investigations	

Course Code: **MMLT-CH-252**	**Skill Enhancement Course -6 (SEC-6)** **MMLT-Semester II** **Practical: Immunohaematology & Blood banking Techniques-II**	**P-2 C-1**
Course Content:		
1.	ELISA for HBs Ag detection	
2.	HCB antibody detection by ELISA	
3.	Preparation of platelet concentrates by PRP method	
4.	Testing of hematological parameters of blood products	

Course Code: **MMLT-CH-253**	**Skill Enhancement Course -7 (SEC-7)** **MMLT- Semester-II** **Clinical Training**
	Students shall be deputed to various labs of 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 various posting. Student's performance shall be evaluated on continuous basis by the faculty posted in various sections.

Course Code: MMLT-CH-301	**Discipline Specific Course -5(DSC-5)** **MMLT- Semester-III** **Clinical Haematology (Neoplastic)**	**L-4 T-0 P-2 C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Applying basic principles for diagnosis of hematopoietic-Lymphoid neoplasm.	
CO2.	Analyzing various hematological disorders	
CO3.	Analyzing the complications of hematopoietic neoplasm	
CO4.	Evaluation of molecular and cellular findings	
CO5.	Evaluating protein abnormalities in Plasma cell dyscrasis	
Course Content:		
Unit-1:	Principles of diagnosis of hematopoietic-Lymphoid neoplasm Classification of hematopoietic neoplasm Classification of lymphoid neoplasm	**6 Hours**
Unit-2:	Basic introduction of molecular genetics of myeloid leukemia's, CBF translocation, RAR translocation Basic introduction molecular genetic of lymphoid leukemia's, tel gene translocation,E2A 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	**7 Hours**
Unit-3:	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	**8Hours**
Unit-4:	Classification of acute leukemia's Acute lymphoblastic leukemia's, clinical features, diagnosis,	**8 Hours**

	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-5:	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	**7Hours**
Text Books:	1. ***Wintrobe's Clinical Hematology,(2014),13th edition, Lippincott Williams & Wilkins***	
Reference Books:	1. ***Haematology, Mckenzie, 3rdEdition*** 2. ***Compendium of Trasfusion medicine, Dr RNMakroo*** 1. ***http://www.mefos.unios.hr/index.php/de/diplomski-mld-eng-1/mandatory-courses/clinical-haematology*** 2. ***https://www.blood-academy.com/***	

Course Code: MMLT-CH-302	**Core Course -3(CC-3)** **MMLT- Semester-III** **Cytogenetics and Molecular Diagnosis**	**L-4** **T-0** **P-2** **C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Applying various cytogenetic and molecular diagnostic techniques	
CO2.	Applying various techniques for purification and separation of nucleic acids	
CO3.	Analyzing banding techniques and karyotyping	
CO4.	Analyzing chromosomal abnormalities	
CO5.	Evaluating different types of body fluids	
Course Content:		
Unit-1:	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.	**6 Hours**
Unit-2:	Chromosome structure and morphology, chromosomal abnormalities, numerical and structural abnormalities, cytogenetic nomenclature Processing of specimens, Banding techniques, karyotyping, spectral karyotyping,	**7 Hours**
Unit-3:	Blotting Techniques, southern blot analysis, PCR, variants of PCR, ISH, FISH Molecular diagnosis of sickle cell anaemia,CML, AML-M3, Thalassemia.	**8Hours**

Unit-4:	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	**8 Hours**

Unit-5:	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	**7Hours**
Text Books:	1. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition,Elsevier Publications	
Reference Books:	1. ***Biochemistry, USatyanarayan*** 2. ***Medical Biochemistry, RajaBin*** 1. ***https://journals.sagepub.com/doi/full/10.1177/0004563214541364*** 2. ***https://www.jaypeebrothers.com/pgDetails.aspx?book_id=9789386150196***	

Course Code: MMLT-CH-303	**Core Course -4(CC-4)** **MMLT- Semester-III** **General Pathology**	**L-2** **T-0** **P-0** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Applying the knowledge of medical terminology	
CO2.	Applying information about disease etiology and development regarding prevention and wellness	
CO3.	Analyzing the etiological factors that are known to be involved malfunctioning of the normal process.	
CO4.	Analyzing the normal process that are foundation material for topics in general pathology	
CO5.	Evaluating the clinical findings	
Course Content:		
Unit-1:	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	**6 Hours**
Unit-2:	Introduction of Repair and regeneration, fibrosis, wound healing Introduction of edema, hyperemia, hemorrhage, hemostasis and thrombosis, embolism, infarction and shock	**7 Hours**
Unit-3:	Introduction of neoplasia, benign and malignant neoplasms, Brief knowledge on carcinogenesis, oncogenes and cancer, proto-oncogenes, etiology of cancer.	**8Hours**
Unit-4:	Environmental pollution, injury by chemical agents, physical agents, nutritional diseases such as PEM, Vitamins deficiency, trace elements	**8 Hours**

Unit-5:	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	**7Hours**
Text Books:	1. *Robbins,(2012), Text book of Pathology, 3rd edition, Elsevier Publications*	
Reference Books:	1. ***Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein'sMicrobiology. 9th edition. McGraw Hill HigherEducation*** 2. ***Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, NewYork.*** 3. ***https://www.clinicalmicrobiologyandinfection.com/issue/S1198-743X(16)X0016-X*** 4. ***https://www.cdc.gov/labtraining/training-courses/basic-microbiology/index.html***	

Note: Course Outcomes of following practical's are covered in their respective theory courses

Course Code: MMLT-CH-351	**Skill Enhancement Course -8 (SEC-8) MMLT- Semester-III** **Practical: Clinical Haematology (Neoplastic)**	**P-2 C-1**
1.	Common Hematological Counts (TLC, DLC) & Interpretation of ESR	
2.	Investigations in Leukemia.	
3.	Serous effusion examination.	
4.	Investigations in hemorrhagic disorders	

Course Code: **MMLT-CH-352**	**Skill Enhancement Course -9 (SEC-9)** **MMLT- Semester-III** **Practical: Cytogenetics and Molecular Diagnosis**	**P-2 C-1**
1.	Polymerase chain reaction and real-time PCR	
2.	Fluorescent in situ hybridization.	
3.	Spectral karyotype imaging.	
4.	DNA microarrays	

Course Code: **MMLT-CH-353**	**Skill Enhancement Course -10(SEC-10)** **MMLT- Semester-III** **Clinical Training**
	Students shall be deputed to various labs of 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 various posting. Student's performance shall be evaluated on continuous basis by the faculty posted in various sections.

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

Course Code: MMLT-CH-451	**Skill Enhancement Course -11 (SEC-11) MMLT- Semester-IV**	**P-24 C-12**
1.	Dissertation	

MONITORING LEARNING PROGRESS

It is essential to monitor the learning progress of each candidate through continuous appraisal and regular assessment. It not only helps teachers to evaluate students, but also students to evaluate themselves. The monitoring is done by staff of the department based on participation of students in various activities. It may be structured and assessment shall be done using checklists that assess various aspects. Model checklists are given which may be copied and used.

a. Journal Review Meeting (Journal Club): the ability to do literature search, in depth study, presentation skills, and use of audio- visual aids are to be assessed. The assessment is made by faculty members and peers attending the meeting using a checklist (see Model Checklist I).
b. Seminars/ symposia: the topics should be assigned to the student well in advance to facilitate in depth study. The ability to do literature search, in depth study, presentation skills and use of audio- visual aids are to be assessed using a checklist (see Model Checklist II).
c. Records: records, log books and marks obtained in tests will be maintained by the Head of the Department and will be made available to the University.

Format of Model Checklists

Checklist- I: MODEL CHECKLIST FOR EVALUATION OF JOURNAL REVIEW PRESENTATIONS

Name of the student: Date:
Name of the faculty/ observer:
Title of the paper:
Journal detail:

Sl. No.	Items of observation during presentation	Poor 0	Below average 1	Average 2	Good 3	Very good 4
1	Article chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been consulted					
5	Ability to respond to questions on the paper/ subject					
6	Audio- visual aids used					
7	Ability to defend the paper					
8	Clarity of presentation					
9	Any other observation					
	Total score					
Remarks						

Name and Signature of the Faculty

Checklist- II: MODEL CHECKLIST FOR THE EVALUATION OF THE SEMINAR PRESENTATIONS

Name of the student: Date:
Name of the faculty/ observer: Title of the seminar:

Sl. No.	Items of observation during presentation	Poor 0	Below average 1	Average 2	Good 3	Very good 4
1	Topic chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been consulted					
5	Ability to respond to questions on the paper/ subject					
6	Audio- visual aids used					
7	Ability to defend the topic					
8	Clarity of presentation					
9	Any other observation					
	Total score					
Remarks						

Name and Signature of the Faculty

Checklist- III:

CONTINOUS EVALUATION OF DISSERTATION WORK BY GUIDE/ CO- GUIDE

Name of the student: Date:
Name of the faculty/ observer: Topic:

Sl. No.	Points of observation during presentation	Poor 0	Below average 1	Average 2	Good 3	Very good 4
1	Periodic consultation with guide/ co-guide					
2	Depth of Analysis/ Discussion					
3	Department presentation of findings					
4	Quality of Final Output					
5	Others					
	Total score					
Remarks