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University of Mumbai

No. UG/ 30 of 2021-22
Mumbai – 400 032.
1st July, 2021.

To
The Principal ,
Vikas College
of Arts, Science & Commerce,
Vikroli (E),
Mumbai – 400 083.

Sir,

I am to invite your attention to the ordinances, Regulations and Syllabus relating to the **Master of Vocation (Medical Laboratory Technology) (CBCS) (Sem .- I to VI)** and to inform you that the resolution passed by the Board of Deans at its meeting held on 27th January, 2021 **vide** item No. **6.7 (N)** have been accepted by the Academic Council at its meeting held on **23rd February, 2021 vide** item No. **6.7** and subsequently approved by the Management Council at its meeting held on **09th April, 2021 vide** item No. **15** and that in accordance therewith, in exercise of the powers conferred upon the Management Council under Section 74(4) of the Maharashtra Public Universities Act, 2016 (Mah. Act No. VI of 2017) the **Ordinance 6619 & 6620 Regulations 9362 & 9363** and the syllabus of **Master of Vocation (Medical Laboratory Technology)** has been introduced as the said course has been sanctioned by the U.G.C., New Delhi, under NSQF and the same have been brought into force with effect from the academic year **2020-21**, accordingly. (The same is available on the University's website www.mu.ac.in).

(Dr. B.N. Gaikwad)
I/c. REGISTRAR

MUMBAI – 400 032
1st July, 2021

A.C/6.7/23/02/2021
M.C/15/09/04/2021

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No. UG/ 30 -A of 2021-22 MUMBAI-400 032 1st July, 2021

Copy forwarded with Compliments for information to:-

1) The Chairman, Board of Deans,
2) The Director, Board of Examinations and Evaluation,
3) The Director, Board of Students Development,
4) The Co-ordinator, University Computerization Centre,

(Dr. B.N. Gaikwad)
I/c. REGISTRAR

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Copy to :-

1. **The Deputy Registrar, Academic Authorities Meetings and Services (AAMS),**
2. **The Deputy Registrar, College Affiliations & Development Department (CAD),**
3. **The Deputy Registrar, (Admissions, Enrolment, Eligibility and Migration Department (AEM),**
4. **The Deputy Registrar, Research Administration & Promotion Cell (RAPC),**
5. **The Deputy Registrar, Executive Authorities Section (EA),**
6. **The Deputy Registrar, PRO, Fort, (Publication Section),**
7. **The Deputy Registrar, (Special Cell),**
8. **The Deputy Registrar, Fort/ Vidyanagari Administration Department (FAD) (VAD), Record Section,**
9. **The Director, Institute of Distance and Open Learning (IDOL Admin), Vidyanagari,**

They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above circular and that on separate Action Taken Report will be sent in this connection.

1. **P.A to Hon'ble Vice-Chancellor,**
2. **P.A Pro-Vice-Chancellor,**
3. **P.A to Registrar,**
4. **All Deans of all Faculties,**
5. **P.A to Finance & Account Officers, (F.& A.O),**
6. **P.A to Director, Board of Examinations and Evaluation,**
7. **P.A to Director, Innovation, Incubation and Linkages,**
8. **P.A to Director, Board of Lifelong Learning and Extension (BLLE),**
9. **The Director, Dept. of Information and Communication Technology (DICT) (CCF & UCC), Vidyanagari,**
10. **The Director of Board of Student Development,**
11. **The Director, Department of Students Walfare (DSD),**
12. **All Deputy Registrar, Examination House,**
13. **The Deputy Registrars, Finance & Accounts Section,**
14. **The Assistant Registrar, Administrative sub-Campus Thane,**
15. **The Assistant Registrar, School of Engg. & Applied Sciences, Kalyan,**
16. **The Assistant Registrar, Ratnagiri sub-centre, Ratnagiri,**
17. **The Assistant Registrar, Constituent Colleges Unit,**
18. **BUCTU,**
19. **The Receptionist,**
20. **The Telephone Operator,**
21. **The Secretary MUASA**

for information.

The Semester End Examinations for Semesters I,II,III&IV shall be conducted by the University and the results shall be declared after processing the internal assessment and the marks awarded to the learners. The grade card shall be issued by the University after converting the marks into grades.

3. Eligibility for Admission: -0.6620

Master of Vocation in Medical Laboratory Technology (M.L.T)		Admissions will be on merit (percentage of aggregate marks/ grade secured at the qualifying examination). Reservation criteria will be followed as prescribed by the government at the time of admissions. The admission should be strictly on merit for the seats allotted by the University. While drawing the merit list, weightage to be given as below:

MAJOR	Weightage	ANCILLARY
B.Voc. (M.L.T.)	50%	----
B.Sc. (Life Science/ Zoology/ Biomedical/ Microbiology/ Biotechnology/ Biochemistry/ M.L.T. / Applied or Allied Biological Sciences)	40%	Chemistry up to Second Year B.Sc.
Bachelor in Pharmacy	5%	----
Bachelor's Degree in Medicine (M.B.B.S. / B.D.S. / B.A.M.S. / B.H.M.S./B.P.T./B.O.T.)	5%	----

4. Course Duration and Level of Awards:-

The course duration and certification levels will lead to M.Voc. Degree in Medical Laboratory Technology. M.Voc. Degree (Sem I & II) and Sem III & IV) to be awarded by University of Mumbai and the semesters I, II, III & IV examinations will be conducted by University of Mumbai for award of M.Voc. Degree.

M.Voc.(Medical Laboratory Technology) :- 2 Years (Four Semesters (I, II, III,IV))

5. Student In-take capacity: R.9362

One division of 20 seats each in (M.Voc (MLT- Part-I) and (M.Voc.(MLT) Part-II)

8. FEES STRUCTURE FOR M.VOC.(M.L.T.): R-9363

VidyaVikas Education Society's		
Vikas College of Arts, Science & Commerce		
M.Voc (Medical Laboratory Technology)		
Fees Structure (Academic Year 2020-2021)		
(Subject to revision, if any, as per University of Mumbai)		
Particulars	M.Voc (Medical Laboratory Technology)	
	Part I	Part II
Tution Fees	15000	15000
Other & E.C.A	250	250
Uni.Exam Fee/ Marksheet	2820	2820
Laboratory Fee	22000	22000
Library Fee	1000	1000
Gym Fee	400	400
Adm.Proc.	200	200
V C Fund	20	20
Magazine Fee	100	100
ID Fee	50	50
Group Insurance	40	40
Students Welfare Fund	50	50
Uni.Sports& Cultural Fees	30	30
Development Fee	500	500
Utility Fee	250	250
Computer Internet	500	500
E-Suvidha	50	50
E- Charges	20	20
Disaster Relief Fund	10	10
NSS EkakYojana Fee	10	10
Project Fee	---	2000
Registration Fee	1000	---
Registration Form Fee	25	---
Covocation Fee	---	250
Exam Fees to Sector Skill Council	1600	1600
Caution Money	150	---
Library Deposit	250	---
Laboratory Deposit	400	---
Total	46725	47150

Justification for New Syllabus and Course M.Voc. (Medical Laboratory Technology)

1. **Necessity of starting these courses:**

   Objectives for Starting M. Voc (Medical Laboratory Technology)

   i. To provide vertical mobility to students coming out of Bachelor of Vocation (B. Voc) Medical Laboratory Technology started from Academic Year 2014 onwards.
   ii. To provide training from entry level jobs to entrepreneurship.
   iii. To integrate National Skill Qualification Framework (NSQF) within the Post Graduate Level of Higher Education in order to enhance the employability of the Graduates and meet Industry requirements. Such graduates are also expected to be equipped to become part of global workforce.

2. **Whether UGC has recommended to start the said courses?**

   Yes. With reference to Letter F. No. 1-25/2018 (NSQF)/756 Dated: 30/07/2019, UGC conveyed the approval to The Principal, Vikas College of Arts, Science & Commerce for offering M. Voc (Medical Laboratory Technology) from academic year 2019-20.

3. **Whether all the courses have commenced from the academic year 2019-20?**

   As Government Resolution for starting Skill Courses (4th March, 2020), No Objection Certificate from Joint Director of Higher Education Mumbai (17th August, 2020) and Affiliation letter from University of Mumbai received on 25th August, 2020, M. Voc (Medical Laboratory Technology) course has been started from Academic Year 2020-2021.

4. **The courses started by the University are self-financed, whether adequate number of eligible permanent Faculties are available?**

   The M. Voc (Medical Laboratory Technology) is a self-financed new post graduation programme, as UGC will not give grant – in – aid for B. Voc Colleges after startup grant. The college have to recover the expenses incurred from student fees as per existing fees fixation policy.

Vikas College of Arts, Science & Commerce have appointed required eligible teaching staff for Academic Year 2020-21.

VIDYA VIKAS EDUCATION SOCIETY						
VIKAS COLLEGE OF ARTS, SCIENCE AND COMMERCE						
M.VOC (MEDICAL LABORATORY TECHNOLOGY) TEACHING STAFF DETAILS (2020-21)						
SR. NO	**NAME OF FACULTY**	**DESIGNATION**	**DATE OF APPOINTMENT**	**QUALIFICATION**	**Appointment**	**EXPERIENCE**
1	Mrs. Mitali Anand Sawant	Assistant Professor	04.07.2017	M.Sc. In Life Science, M.sc in Analytical and Medicinal Chemistry, B. Sc in Microbiology Bachelor of Education (B. Ed.)	Full Time	11 Years
2	Dr. Sonal Upaddhya	Assistant Professor	01.07.2016	Ph. D (Microbiology) M.Sc. (Microbiology) B. Sc (Microbiology)	Full Time	11 Years
3	Ms. Deepika Dinkar Mestry	Assistant Professor	01.07.2017	M.Sc. In Life Sciences B.Sc. in Zoology, Bachelor of Education (B. Ed.)	Full Time	4 Years
4	Mr. Harshad Gajanan Karle	Assistant Professor	21.07.2017	M.Sc. Biotechnology	Full Time	4 Years
5	Ms. Pranali Mahendra Gaikwad	Assistant Professor	01.08.2019	M. Sc in Nutraceuticals , B. Sc. in Biotechnology	Full Time	1.5 Years
6	Dr.(Prof.) Suryakant G.Yeragi	Retired Professor & Scientist	01.07.2014	Ph.D.(Zoology), M.Sc., B.Sc.	Visiting	35 Years
7	Dr. (Mrs.) Supreeya S. Yeragi	Retired Professor & Scientist	01.07.2019	Ph.D., M.Sc. B.Sc.	Visiting	30 Years
8	Dr. Hitesh D. Pagare	Visiting Professor	01.12.2020	M. D. (Path) MBBS	Visiting	15 Years

5. To give details regarding duration of the Course and is it possible to compress the course?

M. Voc (Medical Laboratory Technology) is Two Years (Four Semesters) integrated Full Time Post Graduate Degree Course in Faculty of Science & Technology of University of Mumbai with specialization in Medical Laboratory Technology.

As M. Voc (Medical Laboratory Technology) is Two Years Full Time PG Course with 30 Credit points per semester, it includes Theory lectures, practical and internship. Hence it is not possible to compress the course.

6. The intake capacity of each course and no. of admissions given in current academic year.

Course Name	Approved Intake Capacity by UGC	No. of Admissions in Current Academic Year 2020-21
M. Voc (Medical Laboratory Technology) Part - 1	20	09

7. Opportunities of Employability / Employment available after undertaking these courses.

After completion of M. Voc (Medical Laboratory Technology), the post graduates can work in local and Global industry in senior supervisory level at

- Hospitals (Pathology Lab)
- Clinics (Pathology Lab)
- Medical Labs
- Nursing homes
- Blood Bank
- Diagnostic Centre

  The candidates will be able to work in various job roles such as Medical Lab Technician, Phlebotomy Technician, Blood Bank Technician, Histo-Technican, etc

AC - _____

Item No. _____

UNIVERSITY OF MUMBAI

Syllabus

for the

Program : Master of Vocation

(Medical Laboratory Technology)

Sem.- I, II, III & IV

(Choice Based and Credit System with effect from the academic year 2020-21)

AC - _____

Item No. _____

UNIVERSITY OF MUMBAI

Sr. No.	Heading	Particulars
1	Title of the Course	Master of Vocation (Medical Laboratory Technology) **(M.Voc.M.L.T.)**
2	Eligibility for Admission	B.Voc. (M.L.T.) /B.Sc.(M.L.T.)/ B.Sc.(Life Science/ Zoology/ Biomedical Sciences/ Microbiology /Biotechnology/ Biochemistry/ Applied or Allied Biological Sciences)/ B. Pharmacy / Bachelor's Degree in Medicine(M.B.B.S./ B.D.S./ B.A.M.S./ B.H.M.S./B.P.T./B.O.T.)
3	Passing Marks	40%
4	Ordinances / Regulations (if any)	--
5	No. of Years / Semesters	02 years (04 semesters)
6	Level	~~Certificate~~ / ~~Diploma~~/ ~~U.G.~~/ **P.G.** √ **(Strike out which is not applicable)**
7	Pattern	~~Yearly~~ / **Semester** √ **(Strike out which is not applicable)**
8	Status	~~Revised~~ /**New** √ **(Strike out which is not applicable)**
9	To be implemented from Academic Year	From Academic Year 2020-21

Date:

Name

Signature:

Dr. Anuradha Majumdar
Dean, Science and Technology

Chairman/Principal of BoS

PRINCIPAL
VIKAS COLLEGE OF ARTS, SCIENCE & COMMERCE
Vikhroli (E), Mumbai - 400 083.

PREAMBLE

Master of Vocation (Medical Laboratory Technology)(M.Voc.M.L.T.) (Choice based Credit System) Semester - I, II, III &IV New Syllabus to be sanctioned & implemented from Academic Year 2020-21.

PROGRAM OUTCOME

1. Knowledge, skills, and values that prepare students for future careers in our interconnected society, whether in advanced study
2. This programme will also give students an improved sense of self-confidence and self-efficacy and an awareness of their responsibilities as professionals in their field
3. Learners will comprehend the foundations, process, and practices, and demonstrate proficiency in Laboratory Technology.
4. Understand the role of Healthcare Professionals.
5. Apply knowledge and perform tests of Clinical Biochemistry, Human Anatomy and Medical Parasitology.
6. Apply knowledge and perform tests in Clinical Immunology, Clinical Pathology & Haematology
7. Understand the significance of Community Medicine.
8. Understand Risks and apply Preventive Measures and perform diagnosis of epidemics.
9. Gain knowledge to work as a skilled Technician in Blood Banks.
10. Gain knowledge and assist in Blood Transfusion Process.
11. Study, understand the field of Forensic Science and applications of it.
12. Learn Modern / Advanced Diagnostic Techniques.
13. Apply knowledge of Hospital & laboratory Management.
14. Understand the process of Hospital & Laboratory Accreditation and Certification Process
15. Learn Methodology in Clinical Research.

Dr. Anuradha Majumdar (Dean, Science and Technology)
Prof. Shivram Garje (Associate Dean, Science)
Name of Chairperson (BOS)
Member (BOS)
Member(BOS)
Member(BOS)

Vidya Vikas Education Society's
Vikas Night College of Arts, Science & Commerce

University of Mumbai

Master of Vocation (Medical Laboratory Technology)

Choice Based Credit System (CBCS) (75:25 Pattern)

Syllabus to be implemented from Academic Year 2020-21

1. General Guidelines

The Credits are defined in terms of the learner's hours which are divided into two parts such as Actual and Notional. The value of a particular course can be measured in number ofCred it Points. **The value of One (01) Credit is equal to 15 Hours of learners load.**

The scheme of Examination shall be divided into two parts i.e. Internal Assessmen t includes Assignments, Seminars, Case Studies which will be of 25 marksand the Semester End Examinations which will be of 75 marks. The semester wise Credit Points will be same for all programs & the value of Credits for Post Graduate Programmes shall be of 120 Credits.

Out of 30 credits per semester, the General Education component shall have 40 % of the total credits (12 credit points per Semester) and balance 60 % credits (18 credit points) will be of skill component.

2. Choice Based Credit System (CBCS)

Scheme of Examination

The assessment for the general education component should be done by the university as per their prevailing standards and procedures. The university has to necessarily establish a credit based assessment and evaluation system for the M.Voc. Programme.

For all 4 semesters, the performance of the learners shall be evaluated into two components. The first component shall carry 25% marks which will be an internal assessment while the second co mponent shall carry 75% marks at semester end examination.

The allocation of marks for the Internal Assessment 25% and Semester End Examinations External Assessment 75% are as shown below:

M.Voc. (MLT) Course Structure

Credits and Examination Structure

M.Voc. (MLT) (Part I)/ Post Graduate Diploma										
Semester I						Semester II				
		Credits	Exam					Credits	Exam	
			External	Internal					External	Internal
MMLT101	Theory	4	75	25		MMLT201	Theory	4	75	25
MMLT102	Theory	4	75	25		MMLT202	Theory	4	75	25
MMLT103	Theory	4	75	25		MMLT203	Theory	4	75	25
MMLT104	Theory	4	75	25		MMLT204	Theory	4	75	25
MMLTP101+ MMLTP102	Practical I	4	100	---		MMLTP201 + MMLTP202	Practical III	4	100	---
MMLTP103+ MMLTP104	Practical II	4	100	---		MMLTP203 + MMLTP204	Practical IV	4	100	---
Internship		6	200	---		Internship		6	200	---
Total		**30**	**800**			**Total**		**30**	**800**	

M.Voc . (MLT) (Part II)										
Semester III						Semester IV				
		Credits	Exam					Credits	Exam	
			External	Internal					External	Internal
MMLT301	Theory	4	75	25		MMLT401	Theory	4	75	25
MMLT302	Theory	4	75	25		MMLT402	Theory	4	75	25
MMLT303	Theory	4	75	25		MMLT403	Theory	4	75	25
MMLT304	Theory	4	75	25		MMLT404	Theory	4	75	25
MMLTP301 + MMLTP302	Practical I	4	100	---		MMLTP401 + MMLTP402	Practical III	4	100	---
MMLTP303 + MMLTP304	Practical II	4	100	---			(Project)	4	100	---
Internship		6	200	---		Internship		6	200	---
Total		**30**	**800**			**Total**		**30**	**800**	

The assessment of Part ‘A’ i.e. Internal Assessment as mentioned above for the Se mesters I, II, III & IV shall be processed by the colleges ‘Institutions of their learners’ admitted for the programme.

For part B that is semester end examination of the semesters I,II,III & IV , the University shall conduct the assessment.

The Internal Assessment marks of learners appearing for Semesters I,II,III&IV shall be s ubmitted to the University by the respective colleges/ Institutions before the commencement of r espective Semester End Examinations.

The Semester End Examinations for Semesters I,II,III&IV shall be conducted by the Uni versity and the results shall be declared after processing the internal assessment & the marks awa rded to the learners. The grade card shall be issued by the University after converting the marks into grades.

3. Eligibility for Admission:

<table>
<tr><td rowspan="5">Master of Vocation in Medical Laboratory Technology M.Voc.(M.L.T)</td><td></td><td colspan="3">Admissions will be on merit (percentage of aggregate marks/ grade secured at the qualifying examination).
Reservation criteria will be followed as prescribed by the government at the time of admissions.
The admission should be strictly on merit for the seats allotted by the University.
While drawing the merit list, weightage to be given as below:</td></tr>
<tr><td colspan="2">MAJOR</td><td>Weightage</td><td>ANCILLARY</td></tr>
<tr><td colspan="2">B.Voc. (M.L.T.)</td><td>50%</td><td>----</td></tr>
<tr><td colspan="2">B.Sc. (Life Science/ Zoology/ Biomedical/ Microbiology/ Biotechnology/ Biochemistry/ M.L.T. / Applied or Allied Biological Sciences)</td><td>40%</td><td>Chemistry up to Second Year B.Sc.</td></tr>
<tr><td colspan="2">Bachelor in Pharmacy</td><td>5%</td><td>----</td></tr>
<tr><td colspan="2">Bachelor’s Degree in Medicine (M.B.B.S. / B.D.S. / B.A.M.S. / B.H.M.S./B.P.T./B.O.T.)</td><td>5%</td><td>----</td></tr>
</table>

4. Course Duration and Level of Awards:-

The course duration and certification levels will lead to Post Graduate Diploma / M.Voc. Degree in Medical Laboratory Technology. Post Graduate Diploma / M.Voc. (M.L.T.)(Part –I) (Sem I & II) and M.Voc.(M.L.T.) (Part-II) Degree (Sem III & IV) to be awarded byUniversity of Mumbai and the semestersI,II,III& IV examinations will be conducted by University of Mumbai for award of M.Voc. Degree.

P. G.Diploma (Medical Laboratory Technology)/
M.Voc.(M.L.T.) Part-I :- 1 Year (Two Semesters (I & II))

M.Voc.(Medical Laboratory Technology) :- 2 Years (Four Semesters (I, II, III,IV))

5. Student In-take capacity:

One division of 20 seats each in(P.G.Diploma/**M.Voc.M.L.T.(Part –I))**and**M.Voc. (Part –II) Degree.**

6. Course Contents:-

According to M.Voc.guidelines of UGC, The curriculum in each of the years of the M.Voc. programme would be a suitable mix of General Education and Skill Development Components. Out of 30 credits per semester, theGeneral Education component shall have 40 % of the total credits (12 credit points per Semester) and balance 60 % credits (18 credit points) will be of skill component.

7. PERFORMANCE GRADING:

The Performance grading of the learners shall be on the 10 Point ranking system as under.

Percentage of Marks Obtained	**Grade Point**	**Grade**	**Performance**
80.00 and above	10	O	Outstanding
70-79.99	9	A+	Excellent
60-69.99	8	A	Very Good
55-59.99	7	B+	Good
50-54.99	6	B	Above Average
45-49.99	5	C	Average
40-44.99	4	D	Pass
Less than 40	0	F	Fail

The Performance grading shall be based on the aggregate performance of Internal Assessment and Semester End Examination.

8. PASSING STANDARD:

The Learners to pass course shall have to obtain a minimum of 40% marks in aggregate for each course where the course consist of Internal Assessment and Semester End Examination. The Learners shall obtain minimum 40% marks (ie.10 Out of 25) in the internal assessment and 40% marks in Semester End Examination (ie.30 out of 75) separately, to pass the course and minimum of Grade D in each project wherever applicable, to pass the particular semester. A Learner will be said to have passed the course if the learner passes the internal assessment & Semester End Examination together.

9. FEES STRUCTURE FOR M.VOC.(M.L.T.):

VidyaVikas Education Society's		
Vikas Night College of Arts, Science & Commerce		
M.Voc (Medical Laboratory Technology)		
Fees Structure (Academic Year 2020-2021)		
(Subject to revision, if any, as per University of Mumbai)		
Particulars	M.Voc (Medical Laboratory Technology)	
	Part I	Part II
Tution Fees	15000	15000
Other & E.C.A	250	250
Uni.Exam Fee/ Marksheet	2820	2820
Laboratory Fee	22000	22000
Library Fee	1000	1000
Gym Fee	400	400
Adm.Proc.	200	200
V C Fund	20	20
Magazine Fee	100	100
ID Fee	50	50
Group Insurance	40	40
Students Welfare Fund	50	50
Uni.Sports& Cultural Fees	30	30
Development Fee	500	500
Utility Fee	250	250
Computer Internet	500	500
E-Suvidha	50	50
E- Charges	20	20
Disaster Relief Fund	10	10
NSS EkakYojana Fee	10	10
Project Fee	---	2000
Registration Fee	1000	---
Registration Form Fee	25	---
Covocation Fee	---	250
Exam Fees to Sector Skill Council	1600	1600
Caution Money	150	---
Library Deposit	250	---
Laboratory Deposit	400	---
Total	46725	47150

Master of Vocation (Medical Laboratory Technology)

Eligibility	:	B.Voc. (M.L.T.) / B.Sc. (Life Science/ Zoology/ Microbiology/Biotechnology/Biochemistry/ M.L.T./Biomedical Sciences/ Applied or Allied Biological Sciences)/ B. Pharmacy / Bachelor's Degree in Medicine (M.B.B.S./ B.D.S./ B.A.M.S./ B.H.M.S./B.P.T./B.O.T.)
Programme Duration :	2 Years	
Programme Objectives :		The two- year course in Master of Vocation (Medical Laboratory Technology) is designed to enable prospective learners to achieve the following objectives: 1. Promotion of competencies for performing microscopic and bacteriological tests of human blood, tissues and body fluids for diagnostic and research purposes. 2. Development of knowledge on innovative practices in medical and health care system. 3. Practice and use of various techniques relating to clinical laboratory analyses. 4. Maintenance and care of laboratory Instruments and Equipments 5. Gain knowledge on indexing, recording and storage of medical records and reports of patients. 6. Develop knowledge to be involved in a variety of routine administrative and clinical tasks. 7. Gain knowledge of Hospital and Laboratory Management, Accreditation and Certification Processes.
Job Prospects	:	After the completion of M.Voc.MLT, a challenging career in Government, NGOs Operated and Private Hospitals, Private Medical Laboratory, Blood Banks, Practitioner's (Doctor's)Clinics. Common job profiles of students after completing M. Voc. (MLT) include: Technician in Blood Banks, Hospitals, Nursing Homes and Diagnostic Laboratories.

Vidya Vikas Education Society's

Vikas College of Arts, Science & Commerce

Kannamwar Nagar-2, Vikhroli (East), Mumbai 400083

Master of Vocation (Medical Laboratory Technology)

M.Voc. (MLT) Syllabus

Part I & Part II

	Part I/ (P.G. Diploma)		**Part II**	
	Semester I	**Semester II**	**Semester III**	**Semester IV**
Paper I	Fundamentals of Medical Laboratory Technology	Clinical Techniques & Organ Function Tests	Community Medicine, Epidemiology & Life Style Disorders	Forensic Science, Pharmaceutical Chemistry, Toxicology
Paper II	Principles of Biochemistry & Clinical Biochemistry	Clinical Immunology & Immunopathology	Endocrinology, Metabolic &Nutritional Biochemistry	Modern Diagnostics – Separation Techniques & Non-invasive Techniques
Paper III	Human Anatomy & Physiology	Clinical Pathology, Cytogenetics& Molecular Biology	Blood Banking & Blood Transfusion	Hospital & Laboratory Management, Modern Clinical Practices & Ethics
Paper IV	Medical Parasitology, Mycology & Virology	Haematology, Fluid Analysis & Human Disorders	Histopathology & Modern Diagnostics	Research Methodology & Biostatistics

M.Voc. (MLT) Course Structure

Credits and Examination Structure

M.Voc. (MLT) (Part I)/ Post Graduate Diploma										
Semester I						Semester II				
		Credits	Exam					Credits	Exam	
			External	Internal					External	Internal
MMLT101	Theory	4	75	25		MMLT201	Theory	4	75	25
MMLT102	Theory	4	75	25		MMLT202	Theory	4	75	25
MMLT103	Theory	4	75	25		MMLT203	Theory	4	75	25
MMLT104	Theory	4	75	25		MMLT204	Theory	4	75	25
MMLTP101+ MMLTP102	Practical I	4	100	---		MMLTP201 + MMLTP202	Practical III	4	100	---
MMLTP103+ MMLTP104	Practical II	4	100	---		MMLTP203 + MMLTP204	Practical IV	4	100	---
Internship		6	200	---		Internship		6	200	---
Total		**30**	**800**			**Total**		**30**	**800**	

M.Voc . (MLT) (Part II)										
Semester III						Semester IV				
		Credits	Exam					Credits	Exam	
			External	Internal					External	Internal
MMLT301	Theory	4	75	25		MMLT401	Theory	4	75	25
MMLT302	Theory	4	75	25		MMLT402	Theory	4	75	25
MMLT303	Theory	4	75	25		MMLT403	Theory	4	75	25
MMLT304	Theory	4	75	25		MMLT404	Theory	4	75	25
MMLTP301 + MMLTP302	Practical I	4	100	---		MMLTP401 + MMLTP402	Practical III	4	100	---
MMLTP303 + MMLTP304	Practical II	4	100	---			(Project)	4	100	---
Internship		6	200	---		Internship		6	200	---
Total		**30**	**800**			**Total**		**30**	**800**	

M.Voc. (MLT) Course Structure

M.Voc. (MLT) (Part I) / Post Graduate Diploma

Semester I

Course Code	Title	Theory / Practical	Marks	Credits	No. of Lectures/ Week
MMLT101	Fundamentals of Medical Lab Tech	Theory	100	4	4
MMLT102	Clinical Immunology &Immunopathology	Theory	100	4	4
MMLT103	Human Anatomy & Physiology	Theory	100	4	4
MMLT104	Medical Parasitology, Mycology & Virology	Theory	100	4	4
MMLTP101+ MMLTP102	Practical I	Practical	100	4	8
MMLTP103+ MMLTP104	Practical II	Practical	100	4	8
Internship (At Microbiology / Virology Laboratory/ Department of Hospital / Advanced Diagnostic Centre / Research Institute)		----	200	6	----
	Total		**800**	**30**	**32**

Semester II

Course Code	Title	Theory / Practical	Marks	Credits	No. of Lectures/ Week
MMLT201	Clinical Techniques & Organ Function Tests	Theory	100	4	4
MMLT202	Clinical Immunology & Immunopathology	Theory	100	4	4
MMLT203	Clinical Pathology, Cytogenetics& Molecular Biology	Theory	100	4	4
MMLT204	Haematology, Fluid Analysis & Human Disorders	Theory	100	4	4
MMLTP201 + MMLTP202	Practical III	Practical	100	4	8
MMLTP203 + MMLTP204	Practical IV	Practical	100	4	8
Internship(At Molecular Biology Department of Hospital / Research Institute / Pharmaceutical Company)		----	200	6	----
	Total		**800**	**30**	**32**

M.Voc. (MLT) Course Structure

M.Voc. (MLT) (Part II)

Semester III

Course Code	Title	Theory / Practical	Marks	Credits	No. of Lectures/ Week
MMLT301	Community Medicine, Epidemiology & Life Style Disorders	Theory	100	4	4
MMLT302	Endocrinology, Metabolic & Nutritional Biochemistry	Theory	100	4	4
MMLT303	Blood Banking & Blood Transfusion	Theory	100	4	4
MMLT304	Histopathology & Modern Diagnostics	Theory	100	4	4
MMLTP301 + MMLTP302	Practical I	Practical	100	4	8
MMLTP303 + MMLTP304	Practical II	Practical	100	4	8
Internship(At Pathology Laboratory (where basic epidemiology tests/ studies are undertaken) of State Government Hospital / Local Governing Body Hospital / Pharmaceutical Company/ Research Institute or at Advanced Blood Bank)		----	200	6	----
	Total		**800**	**30**	**32**

Semester IV

Course Code	Title	Theory / Practical	Marks	Credits	No. of Lectures/ Week
MMLT401	Forensic Science, Pharmaceutical Chemistry, Toxicology	Theory	100	4	4
MMLT402	Modern Diagnostics - Separation Techniques, Non-invasive Techniques	Theory	100	4	4
MMLT403	Hospital & Laboratory Management, Modern Clinical Practices & Ethics	Theory	100	4	4
MMLT404	Research Methodology & Biostatistics	Theory	100	4	4
MMLTP401 + MMLTP402	Practical III	Practical	100	4	8
	Project – Thesis/ Dissertation Submission – Evaluation	Practical	100	4	8
Internship(At Forensic Research Laboratory or Training in Advanced Instrumentation at Pharmaceutical Company / Hospital & Research Centre / Research Institute / Advanced Diagnostic Centre)		----	200	6	----
	Total		**800**	**30**	**32**

M.Voc. (MLT) PART I / Post Graduate Diploma

			SEMESTER I		
Course Code	**Component**	**Unit**	**Topic**	**Credits**	**L/Week**
MMLT101 (Fundamentals of Medical Lab Tech)	Skill	I	Basic Laboratory Principles	4	1
	Skill	II	Common glass wares in clinical laboratory		1
	Skill	III	Laboratory instruments: Introduction		1
	Skill	IV	Clinical samples, Specimens and Solutions		1
MMLT102 (Principles of Biochemistry & Clinical Biochemistry)	Skill	I	Biophysical Chemistry, Bioenergetics	4	1
	Skill	II	Radioactivity, Immunoassays		1
	Skill	III	Disorders and Inborn Errors of : Carbohydrate, Protein & Lipid Metabolism, Organ Function Tests		1
	Skill	IV	Clinical Enzymology, Electrolytes & Blood Gas Analysis, Biochemical aspects of Hematology		1
MMLT103 (Human Anatomy & Physiology)	Skill	I	Human Body Overview, Integumentary System	4	1
	Skill	II	Respiratory System, Endocrine System, Neuromuscular System		1
	Skill	III	Human Reproductive System : Male Reproductive System & Hormonal Function, Female Reproductive System & Hormonal Function		1
	Skill	IV	Pregnancy, Foetal and Neonatal Physiology & Paediatric Diseases, Pathology		1
MMLT104 (Medical Parasitology, Mycology & Virology)	Skill	I	Medical Bacteriology,	4	1
	Skill	II	Medical Virology		1
	Skill	III	Medical Mycology & Medical Parasitology		1
	Skill	IV	Culture Media, Staining Methods, Biochemical Tests, Antibiotic Tests, Staining Methods		1
MMLTP101	Skill		Practical of Course MMLT101	2	4
MMLTP102	Skill		Practical of Course MMLT102	2	4
MMLTP103	Skill		Practical of Course MMLT103	2	4
MMLTP104	Skill		Practical of Course MMLT104	2	4

M.Voc. (MLT) PART I / Post Graduate Diploma

			SEMESTER II		
Course Code	**Component**	**Unit**	**Topic**	**Credits**	**L/Week**
MMLT201 (Clinical Techniques & Organ Function Tests)	Skill	I	Cardiac & Lung Functions	4	1
	Skill	II	Urino-Genital System Function – Male & Female		1
	Skill	III	Liver Function, Gastric, Pancreatic, Intestinal Function		1
	Skill	IV	Thyroid & Salivary Gland Function, Adrenocortical Function, Central Nervous System Function		1
MMLT202 (Clinical Immunology & Immunopathology)	Skill	I	Introduction to Immune System	4	1
	Skill	II	Complement System & Hypersensitivity		1
	Skill	III	Autoimmunity & Immunodeficiency Disorders		1
	Skill	IV	Immunodiagnostics & Prophylactic Immunization		1
MMLT203 (Clinical Pathology,Cytogenetics& Molecular Biology)	Skill	I	Blood & Inflammatory Disorders, Hemodynamic Disorders	4	1
	Skill	II	Genetic Disorders		1
	Skill	III	Recombinant DNA Technology		1
	Skill	IV	Nucleic Acid Analysis		1
MMLT204 (Haematology, Fluid Analysis & Human Disorders)	Skill	I	Blood – Composition, Haemostasis, Coagulation	4	1
	Skill	II	Haemogram, Special Haematological Tests		1
	Skill	III	Body Fluids : Properties, Amniotic, Cerobrospinal, Synovial, Serous, Seminal, Sputum, other body fluids		1
	Skill	IV	Neurological Disorders, Vitamin Deficiencies		1
MMLTP201	Skill		Practical of Course MMLT201	2	4
MMLTP202	Skill		Practical of Course MMLT202	2	4
MMLTP203	Skill		Practical of Course MMLT203	2	4
MMLTP204	Skill		Practical of Course MMLT204	2	4

M.Voc. (MLT) PART II

			SEMESTER III		
Course Code	**Component**	**Unit**	**Topic**	**Credits**	**L/Week**
MMLT301 (Community Medicine, Epidemiology & Life Style Disorders)	Skill	I	Basic Epidemiology	4	1
	Skill	II	Environment and Health		1
	Skill	III	Reproductive and Child Health & Health Education		1
	Skill	IV	Life Style Disorders : Diseases & Mental Health		1
MMLT302 (Endocrinology, Metabolic & Nutritional Biochemistry)	Skill	I	Endocrinology – Concept, Pathology	4	1
	Skill	II	Glands, Hormones		1
	Skill	III	Metabolism & Diseases		1
	Skill	IV	Nutrition & Diseases		1
MMLT303 (Blood Banking & Blood Transfusion)	Skill	I	Blood Banking	4	1
	Skill	II	Storage & Transport		1
	Skill	III	Blood Group, Transfusionology		1
	Skill	IV	Blood Bank Records		1
MMLT304 (Histopathology & Modern Diagnostics)	Skill	I	Histopathology	4	1
	Skill	II	Tissue Processing & Staining		1
	Skill	III	Cervical Cytology & Organ Transplantation		1
	Skill	IV	Recent Advances in Cytopathology		1
MMLTP301	Skill		Practical of Course MMLT301	2	4
MMLTP302	Skill		Practical of Course MMLT302	2	4
MMLTP303	Skill		Practical of Course MMLT303	2	4
MMLTP304	Skill		Practical of Course MMLT304	2	4

M.Voc. (MLT) PART II

			SEMESTER IV		
Course Code	**Component**	**Unit**	**Topic**	**Credits**	**L/Week**
MMLT401 (Forensic Science, Pharmaceutical Chemistry, Toxicology)	Skill	I	Forensic Pharmacology	4	1
	Skill	II	Forensic Toxicology		1
	Skill	III	Drug: Drug, Designing & Screening		1
	Skill	IV	DNA Profiling		1
MMLT402 (Modern Diagnostics - Separation Techniques, Non-invasive Techniques)	Skill	I	Centrifugation, Chromatography, Electrophoresis	4	1
	Skill	II	Analytical Techniques		1
	Skill	III	Medical Imaging		1
	Skill	IV	NMR, Opthalmology, Mammography		1
MMLT403 (Hospital & Laboratory Management, Modern Clinical Practices & Ethics)	Skill	I	Management : Principles, Practices & HR	4	1
	Skill	II	Material Management & Inventory Control		1
	Skill	III	Clinical & Non-Clinical Services, Accreditation		1
	Skill	IV	Reproduction, Bioethics, Therapy, Contemporary Ethical Issues		1
MMLT404 (Research Methodology & Biostatistics)	Skill	I	Research Methodology- Research Field, Review of Literature, Methodology, Analysis & Discussions	4	1
	Skill	II	Research Methodology- Project Proposal		1
	Skill	III	Biostatistics – Descriptive Statistics, Correlation & Regression		1
	Skill	IV	Biostatistics – Statistical inference, Significance Tests, Analysis of Variance, Epidemiology		1
MMLTP401	Skill		Practical of Course MMLT401& MMLT402	4	4
	Skill		Hands-on Project Training – Thesis Submission - Evaluation	4	4
	Skill		Internship	6	
	Skill				

Semester IV Practicals :Hands-on Project Training

It is mandatory for students to undergo Hands-on Project training in an established Laboratory, Hospital, Diagnostic Centre, Pharmaceutical Company, Research Institute for 4-6 months; this should involve relevant instrumentations & techniques. Thesis / Dissertation on the same to be evaluated by the Internal Examiner and External Examiner for 100 Marks based on the students performance, written matter and experimentation. A certificate/ mark list to be appended with the thesis/ Dissertation.

M.Voc. (MLT) Part I – Semester I			
Courses Objectives : The objective of these courses is to understand the role of Healthcare Professionals. To have a firm foundation of the fundamentals and applications of Medical Laboratory Technology. **Learning outcomes :** By the end of all courses the student will be able to : • Understand the role of Healthcare Professionals • Apply knowledge of and perform tests of Clinical Biochemistry, Human Anatomy and Medical Parasitology			
Course Code	Title	Credits	NOS
MMLT101	**Fundamentals of Medical Laboratory Technology**		
UNIT I	**Basic Laboratory Principles**		
	Code of conduct of medical laboratory personnel - Organization of clinical laboratory - Role of medical laboratory technician - Safety measures - Medical laboratory professional and professionalism in laboratory workers - communication between physician and lab technician - hospital and clinic borne infection and personnel hygiene		
UNIT II	**Common glass wares in clinical laboratory**		
	Care and maintenance - Calibration of pipettes and volumetric apparatus - Cleaning and sterilization methods - antiseptics and disinfectants - Principle, care, maintenance and application of Light - Fluorescent - Phase contrast - Electron microscope – staining techniques – vital stains		
UNIT III	**Laboratory instruments: Introduction**		
	Chemical balance: types, principle and practice – Photometry Principles and use- Beer Lambert law – Wavelength, transmittance and absorbance – Centrifuges - Water bath – Refrigerator – Autoclave - Hot air oven – Mixer – Laminar air flow - Water distillation unit (De ionized and double distilled water)- Automation.		
UNIT IV	**Clinical samples, Specimens and Solutions**		
	Specimen collection, transport, storage and disposal –common laboratory infections - Anticoagulants: EDTA, Di-potassium salts of EDTA, double oxalate, single oxalate, sodium citrate and sodium fluoride.		
	Acid - Base balance – Electrolytes - Buffer and pH- Preparation of solution: Normal , per cent and Molar solution - normal saline -Methods of measuring liquids- Clinical laboratory records- Modern laboratory set up Quality control: Accuracy, Precision, and Reference values.		
MMLT102	**Principles of Biochemistry & Clinical Biochemistry**		
UNIT I	**Biophysical Chemistry, Bioenergetics**		
	Biophysical Chemistry: Electrolytes - Definition, ionization of weak acids, weak bases pH,HendersonHasselbach equation; Buffer systems - definition, titration curve of weak acids,buffering capacity, physiological buffers, Respiratory and metabolic acidosis and alkalosis;Osmosis - definition, osmotic crisis,transportation across membrane by membrane proteins; Donnan equilibrium - Keq, membrane hydrolysis. **Biological Oxidation & Bioenergetics:** Entropy, Laws of Thermodynamics, Redox Potential, Enzymes Involved in Oxidation, and Reduction; transport of molecules active and passive; involvement of ATP in biologicalsystems.		
UNIT II	**Radioactivity, Immunoassays**		
	Radioactivity: Radioactivity- types of radioactive decay with examples; Radioactive half-life; Units of radioactivity; Application of radioisotope in clinical chemistry. **Immunoassays and Application To Biochemistry:** Radio Immuno - Assays		

	(RIA);Determination of Hormones by Using Radio Immuno assays (RIA); NonisotopicImmunoAssays; Homogeneous Enzyme Immuno Assays; Heterogeneous Enzyme ImmunoAssays;Enzyme Linked Immuno-Sorbant Assay (ELISA); Chemiluminescence&Bioluminescence;Micropartical Enzyme Immuno assay (MEIA); Fluorescence Polarization Immunoassay(FPIA); Radio Active Energy attenuation (REA) Assays.		
UNIT III	**Disorders and Inborn Errors of Metabolism**		
	Disorders and Inborn Errors of Carbohydrate Metabolism: Diabetes mellitus – diagnosis, gestational diabetes mellitus; Galactosaemia; Glycogen storage diseases - pompe'sdisease, Cori's disease, Hers disease, Von GIERKE disease; Determination of glucose inbody fluids - ketone bodies, lactate and pyruvate; Glycated proteins, urinary albuminexcretion–specimen collection, storage and quantitative assay; Qualitative tests for individualsugars in urine. **Disorders and Inborn Errors of Protein Metabolism:** Plasma proteins, proteins in bodyfluids; Analysis of proteins in blood and other body fluids; Electrophoresis of plasmaproteins; Aminoaciduria-selected disorders of amino acid metabolism-phenylalanine, MSUD, tyrosine, alkaptonuria, melanuria, cystinula, Homocystinuria, Albinism, PKU; Analysis ofamino acids – screening test, quantitative tests for specific amino acids; Acute phase proteins:- Diagnosis and significance of C-reactive proteins, alpha feto proteins, alpha1-antitrypsin, alpha2-macroglobulin, haptoglobulin etc. **Disorders of Lipid Metabolism:** Atherosclerosis and coronary artery disease; Disorders oflipoprotein metabolism; Acyl –COA dehydrogenase, Jamaican Vomiting Sickness,REFSUM's disease, ZELLWENGER's Syndrome, NORUM's Disease, Gaucher Disease; Measurement of lipids, lipoproteins and apolipoproteins; Sources of analytical and biologicalvariations in measurements.		
UNIT IV	**Clinical Enzymology, Electrolytes & Blood Gas Analysis**		
	Clinical Enzymology : Enzymes-Methods of estimation, principles of assay, normal range in tissues and clinical conditions leading to abnormal levels of : SGOT, SGPT, Alkaline phosphatase, Acid phosphatase, Amylase, CPK.		
	Mineral-Methods of estimation, principles of assay, normal range in tissues and clinical conditions leading to abnormal levels of : Na, K, Ca, CI, O_2, CO_2, P, lodine, Nitrogen, Zn, Mg, Li.		
	Hormones-Methods of estimation, principles of assay, normal range in tissues and clinical conditions leading to abnormal levels of: Androgens, Pregnonediol, estrogens, corticosteroids, catecholamine, thyroid, prolactin, growth hormones. FSH,LH, testosterone, β-HCG.		
	Vitamins-Methods of estimation, principles of assay, normal range in tissues and clinical conditions leading to abnormal levels of: Vitamin A, thiamine, Niacin, Pyridoxine, Ascorbic acid, Vitamin D3		
MMLT103	**(Human Anatomy & Physiology)**		
Unit I	**Human Body Overview, Integumentary System**		
	Human Body an overview: Directional and regional terms - Cavities and planes, Tissues: Structure, functionand locations of epithelial, connective and nerve tissues. Skin: Structure, function and pigmentation- SkeletalSystem: axial and appendicular skeleton functions, anatomy, histology, Structural and functional classification of joints and movements. **Integumentary system**: Basic structure and functions of glands, layers and hair follicles. Gastrointestinal system: Dentition –types, Gastro-intestinal enzymes,		

	Structure,absorption		
Unit II	**Respiratory System, Endocrine System, Neuromuscular System**		
	Respiratory system: Structure and function of respiratory organs, Gas exchange, Respiratory volume and capacities, Cardiovascular system: Structure and function of circulatory system: Human heart, blood vessels, lymphatics, Control of heart beat, Cardiac cycle. **Endocrine System:** Basic anatomy and physiology of the Pituitary, Thyroid, Parathyroid, Adrenals, Pancreas, Testes and ovary, their hormones, functions and disorders. **Neuromuscular system:** Basic structure and function of Central Nervous System (CNS), Autonomic Nervous System (ANS) and Peripheral Nervous System (PNS)-Sense organs, Reflexes, Transmission of nerve impulse. Musculoskeletal system –types of muscles,movement and muscle contraction – contractile mechanisms, Neuro-muscular disorders.		
Unit III	**Human Reproductive System : Male& Female Reproductive Systems& Hormonal Function**		
	Male Reproductive System & Hormonal Function: Physiologic anatomy, spermatogenesis, male sexual act, testosterone and other male sexhormones, Abnormalities of male sexual function, male infertility. **Female Reproductive System & Hormonal functions:** Physiologic anatomy, female hormonal system, ovarian cycles, function of estradiolandprogesterone, female sexual act, female infertility; Hormone replacement therapy(HRT),Menopause and post menopause.		
Unit IV	**Pregnancy, Foetal and Neonatal Physiology & Paediatric Diseases, Pathology**		
	Pregnancy:Maturation and fertilization of the ovum, early nutrition of the embryo, function of the placenta, hormonal factors in pregnancy,response of themothers body to pregnancy, parturition. **Fetal and neonatal physiology and pediatric diseases:** Growth and functional development of the fetus, adjustment of the infant to extrauterine life, special functional problems in the neonate, problems of prematurity, congenital anomalies, perinatal infections, syndrome of the newborn, immune hydrops, tumors and tumor like lesions of infancy and childhood. The role of fetal factors in programming adult- onset diseases. **Pathology:** Gynaecological malignancies- ovarian cancer, uterine cancer, cervicalcancer, gestational trophoblastic neoplasia. Sexually transmitted diseases-syphilis,gonorrhoea, trichomoniasis, human papilloma virus infection. Diseases during pregnancy-placental inflammations and infections, ectopic pregnancy, gestational trophoblastic diseases,eclampsia.		
MMLT104	**(Medical Parasitology, Mycology & Virology)**		
Unit I	**Medical Bacteriology**		
	Classification and general properties of medically important bacteria. Recommendation for collection, transportof specimens, isolation of bacteria from clinical specimens. Staphylococcus streptococcus Neisseria andBordetella.Corynebacterium,Listeria,Mycobacetrium.Bacillus,Vibrios,Aeromonas, Campylobacter,Helicobacter, Pseudomonas, Brucella, Haemophilus, Enterobacteriaceae, Salmonella, Shigella, Proteus,Escherichia, Klebsiella, Clostridium, Mycoplasma, Rickettsiae, Spirochaetes, Treponema and Leptospira		
Unit II	**Medical Virology**		
	General Properties of viruses - Detection of viruses and antigens in clinical specimens - Serological diagnosisof virus infections. Cultivation of viruses.Arthropod borne and rodent borne virus diseases - Picornavirusesand diseases. Hepatitis viruses: Rabies and other neuro viruses: Orthoinyxo and paramyxo viruses. Pox,Adeno, Herpes, Reo, Rota		

	and HIV Virses, Oncogenic viruses, Viral vaccines, their Preparation and theirimmunisation schedules. Viruses of importance to bacteria - Bacteriophages - Their structure, types –Typingand application in bacterial genetics		
Unit III	**Medical Mycology & Medical Parasitology**		
	Mycology - Morphology, Taxonomy, clasification of fungi, detection and recovery of fungi from clincicalspecimens.Dermatophytes and agents of superficial mycoses. Trichophyton. Epidermophyton and Microsporurn. Yeasts ofmedical importance-Candida, cryptococcus. Mycotoxins, Dimorphic fungi causing systemic mycoses,Histoplasma, Coccidioides, Opportunistic fungi.Diagnosis of fungal infection. Immunity to fungal infections.Antifungal agents, testing methods and quality control **Parasitology -** Classification, Protozoa - Entamoeba - Plasomodium, Leishmania - Trypanosoma -Giardia Trichomonas - Balantidium.Platyhelminthus -- Taenia - Fasciola - Paragonimus - Schistosorna. Nematihelminthes - Ascaris - Ankylostoma - Enterobius – Trichuris - Wuchereria - Dracunculus.Laboratory techniques in Parasitology. Examination of faeces for ova and cysts - Concentration methods.Blood smear examination for Parasites. Cultivation of Protozoan Parasites.		
Unit IV	**Culture Media, Staining Methods, Biochemical Tests, Antibiotic Tests**		
	Culture Media: Classification of culture Media; Preparation of Culture Media; Quality Control of Culture Media; Inoculation; Incubation & purification methods in bacteriology; Quantification of bacterial growth; Preservation of bacteria. **Staining Methods :** Principles; Preparation of stains and reagents; Preparation of smears; Modification of following staining methods- Simple staining, Differential staining (Gram staining, AFB staining), Negative staining, Fluorochrome staining, Staining of Volutin granules, Staining of spirochetes, Spore staining, Capsular staining, Flagellar staining. **Biochemical Tests for Identification:** Principle, Media & Reagents, Method; Tests for metabolism of : carbohydrates, proteins and amino acids and fats; Tests for enzymes; Rapid identification systems. **Antibiotics**& mechanism of action MIC & MBC (Minimum inhibitory concentration & Minimum bactericidal concentration); In-vitro susceptibility tests diffusion methods; Mechanism of antibiotic resistance		

M.Voc. (MLT) Part I – Semester I - Practicals	
Sr. No.	**Experiment**
	MMLT101 (Fundamentals of Medical Lab Tech)
01	Calibration of pipettes and volumetric apparatus
02	Study of Laboratory Instruments & equipments- Principle, working and applications
03	Collection of Clinical Specimens and Their Processing in Laboratory
04	Preparations of Chemicals
	MMLT102 (Principles of Biochemistry & Clinical Biochemistry)
05	ELISA Test (Direct Method)
06	ELISA Test (Indirect Method)
07	Determination of lactate
08	Determination of pyruvate
09	Detection of Cystine in urine
10	Detection of Tyrosine in urine
11	Determination of Phenylketonuria in urine
12	Electrophoresis of Serum Lipoproteins

13	Separation of sugars by chromatography
14	Separation of Amino Acids by chromatography
15	Determination of electrolytes- Sodium, Potassium, Chloride, Calcium
	MMLT103 (Human Anatomy & Physiology)
16	Study of Integumentary System
17	Study of Endocrine System
18	Study of Hormonal Functions in Male Reproductive System
19	Study of Hormonal Functions in Female Reproductive System
20	Study of Gynaecological Malignancies
21	Study of diseases during pregnancy
	MMLT104 (Medical Parasitology, Mycology & Virology)
22	Study of medically important bacteria from clinical specimens
23	Serological diagnosis of viral infections
24	Detection of fungi from clinical specimens
25	Blood Smear Examination for Parasites

M.Voc. (MLT) Part I / PG Diploma– Semester II

Courses Objectives:

The objective of this course is to have a firm foundation of the fundamentals and applications of Clinical Immunology, Pathology, Molecular Biology & Haematology

Learning outcomes :

By the end of the course the student will be able to :

- Apply knowledge of and perform tests in Clinical Immunology, Clinical Pathology & Haematology

Course Code	Title	Credits	NOS
MMLT201	**Clinical Techniques & Organ Function Tests**		
Unit I	**Cardiac & Lung Functions**		
	Cardiac Function: Definitions of Acute coronary syndrome, angina, coronary artery diseaseischemia, myocardial infarction, plague, atherosclerosis, factors promoting atherosclerosis,Diagrammatic representation of blood flow through heart and lungs, Events leading to an acute myocardial infarction, hypercoagulable state, Cardiac markers, symbolism and embolism **Lung function :** Anatomy of the lung lobule air way obstruction diseases, constrictingdiseases, interstitial diseases, Bronchial asthma, chronic bronchitisemphyscma, Pneumonia, TB, tumors of lung and pleura, plural cavity		
Unit II	**Urino-Genital System Function – Male & Female**		
	Macroscopic and microscopic anatomy of renal system,Nephrone, glomerular filtration rate, plasma renal flow,hemodialysis, hemostasis, erythropoietin, functions of renal system, end stage renal disease, acute renal failure, acute nephroticsyndrome,phyelonephritis and urinary tract obstruction, urine analysis &itsapplications in renal diseases, tumors of the urogenital system, prostaterelated diseases. Female genital system including breast. Diseases of urinary tract (kidney, ureter, bladder), diseases of cervix, cervical carcinoma, vulva, vagina, ureter,uterus, fallopian tubes, ovaries including tumors of these organs (benignbreast diseases, inflammatory diseases,		

	carcinoma breast etc)		
Unit III	**Liver Function, Gastric, Pancreatic, Intestinal Function**		
	Liver Function: Macroscopic and microscopic anatomy of hepatic system, hepatic lobule, portal triad, jaundice, viral and chronic hepatitis,cirrhosis, cholestasis, cholecystitis, liver cancer and secondary tumors, gallbladder tumors, major functions of liver, enzymes synthesized by liver, their functions and clinical significance,three specific patterns of liver cell injury, its causes and symptoms **Gastric, pancreatic and intestinal function:** Ulcer, cystic fibrosis, steatorrhoea, acid peptic diseases, three phases of digestion, structure and function of stomach, intestinal tract and pancreas, function and clinical significance of intrinsic factor, hormones and enzymes synthesized in the GI tract, their functions and clinical significance, Zollinger-Elison syndrome, gastritis, pancreatitis, pancreatic tumor, lactose intolerance and Diabetes Mellitus, stomach, intestine, rectal, benign andmalignanttumors, reflux oesophagititis, hiatus hernia, barret, oesophageal cancer.		
Unit IV	**Thyroid & Salivary Gland Function, Adrenocortical Function, Central Nervous System Function**		
	Thyroid and salivary gland functions : Anatomy of Benign and malignant tumors, Follicle, colloid, thyroglobulin, reverse T3, goiter, Thyrotropin, releasing hormone, tumors of thyroid, structure and function of thyroid gland, synthesis, regulation and metabolism of thyroid hormones, effects of increased and decreased concentrations of thyroid hormones onTSH levels, laboratory tests to assess thyroid gland function, Hashimoto's disease, Graves disease, secondary hyperthyroidism and thyroidantibodies **Adrenocortical Function :** Structure and function of adrenal cortex, synthesis of adrenocortical hormones from cholesterol, hormones synthesized by each specific zone of the adrenal cortex and their function, Adrenal disorders-Addisons's disease, Conn's disease, Cushing's syndrome, congenial adrenal hyperplasia, laboratory tests to assess adrenocortical function. **Central Nervous System:**Anatomy of brain, spinal cord, Meningits, CSF, brain tumors		
MMLT202	**Clinical Immunology & Immunopathology**		
Unit I	**Introduction to Immune System**		
	History of immunology; Concept of Immunity & Immune response; Innate immune system-properties and mechanism, nonspecific defense system; Adaptive immune system-properties and mechanism, cells involved, MHC and its role; Memory, specificity, diversity, self vs non-self-discrimination; Structure and functions of primary and secondary lymphoid organs; Cells Involved in Immune Responses: Phagocytic cells and their killing mechanisms; T and B lymphocytes; Differentiation of stem cells and idiotypic variations. Nature of Antigen and Antibody: Antigen vsImmunogen, Haptens; Structure and functions of immunoglobulin's; Isotypic, allotypic and idiotypic variations		
Unit II	**Complement System & Hypersensitivity**		
	Role of complement system in immune response; Complement		

	components & activation pathways; Monoclonal antibodies-production, characterization & application in diagnosis, therapy & basic research; Important parameters of serological test; Avidity & affinity measurement; Definition of Hypersensitivity, Classification of Hypersensitivity; Factors causing hypersensitivity; Common hypersensitivity reaction; Classification & types of hypersensitivity reaction; Autoimmune diseases		
Unit III	**Autoimmunity & Immunodeficiency Disorders**		
	Mechanisms of induction of organ specific (Hashimoto's thyroiditis, autoimmune anemias, Goodpasture's syndrome, IDDM), and systemic (SLE, multiple sclerosis and rheumatoid arthritis) autoimmunediseases. Animal models of primary immunodeficiency (nude mouse and SCID mouse). Specific impairedfunctions in lymphoid lineage (SCID, Waldanstormagamaglobulinemia, DiGeorge syndrome, common variableimmunodeficiency), myeloid lineage (CGD, congenital neutropenia, Chediak-Higashi syndrome and leucocyteadhesion deficiency)		
Unit IV	**Immunodiagnostics & Prophylactic Immunization**		
	Immunodiagnostics: Precipitation techniques & its application; Procedure, interpretation & application of agglutination, compliment fixation, neutralization & opsonisation; Fluorescence techniques; ELISA; RIA; Double diffusion &Immuno electrophoresis; Procedure & interpretation of VDRL test, WIDAL, Leptospira antibody test, Cryptococcal antibody test, RA Factor, Blood grouping, Rh typing, Coomb's test; Clinical laboratorymethods for- Detection of cellular immune function; Delayed hypersensitivity skin tests; Assay for lymphocytes; Flow cytometry and cell sorting; Monoclonal antibodies, hybridoma technique, purification & characterization, application in biomedical research, clinical diagnosis. Prophylactic Immunization: Concept & definition of immunization; Types of immunization; Introduction to vaccines in detailed; Types of vaccines; National immunization schedule; Vaccines-immunoprophylaxis& immunotherapy; Types of vaccines; Immunity against bacterial, viral, fungal & parasitic diseases, advances in the development of vaccines		
MMLT203	**Clinical Pathology, Cytogenetics& Molecular Biology**		
Unit I	**Blood & Inflammatory Disorders, Hemodynamic Disorders**		
	Blood and Inflammatory Disorders: Haemostasis – disorders and regulation; Types of Anaemia; Bleeding disorders of man; General inflammatory markers and specific therapeutic bioindicators; C reactive protein (CRP); Rheumatoid Arthritis (RA); Anti Streptolysin O(ASO); Acute inflammation - Vascular changes, Cellular Events; Chronic inflammation - Chronic inflammatory cells and mediators, Lymphatics and lymph nodes in inflammation; Systemic effects of inflammation. **Hemodynamic Disorders:** Hyperemia and congestion - Hemorrhage, Hemostasis, and thrombosis, Endothelium platelets, Coagulation cascades, DIC embolism, Pulmonary Thromboembolism, Systemic thromboembolism, Fat Embolism, Air Embolism, Amniotic Fluid Embolism, Infraction.		
Unit II	**Genetic Disorders**		

	Genetic Disorders - Diseases Caused by Change in Structural Proteins &ReceptorProteins: Mutations - Types of mutation, Molecular repair mechanisms, Diseases due to defected repair mechanisms; Mendelian Disorders - Transmission pattern of single gene disorders, Autosomal disorders, Sex chromosome related disorders, MarfanSyndrome,Ehlers-Danlos syndrome, Familial hypercholesterolemia, Diabetes, Protein energy malnutrition's.		
Unit III	**Recombinant DNA Technology**		
	Recombinant DNA Technology: Necessary elements – enzymes and their properties; DNA Ligase; DNA ligase; DNA modifying enzymes; Cloning vectors plasmids; Cosmids; Bacteriophages; Shuttle vectors; Expression vectors; Construction of rDNA and cloning strategies– various methods, genomic libraries (e.g. Using phage vectors), cDNAlibraries;Introduction of rDNA into host-methods; Restriction maps and Sequencing		
Unit IV	**Nucleic Acid Analysis**		
	Nucleic Acid Analysis: Extraction; Purification and analysis of mRNA from eukaryotic cells; Methods for synthesis of double strand cDNA; Expression profiling; Transcriptome analysis; RT PCR and Real Time PCR; Rapid DNA sequencing techniques like Sanger's dideoxynucleotide, partial ribonucleotide substitution; Maxam and Gilbert's method; Pyrosequencing and single molecule sequencing; Genome; Genome sequencing; DNASequence Characterization (Open reading frames, promoters, coding frames)		
MMLT204	**Haematology, Fluid Analysis & Human Disorders**		
Unit I	**Blood – Composition, Haemostasis, Coagulation**		
	Composition of Blood: Components of the blood (Plasma and Cellular elements) and their functions – Haemopoietic system of the body (Leucopoiesis, erythropoiesis and thrombopoiesis) Haemostasis – disorders and regulation – Types of Anaemia (deficiency of iron, B12 and folic acid, hemolytic, aplastic and genetic disorders), Bleeding disorders of man Coagulation of blood: Coagulation system- recalcification time, activated partial thromboplastin time and thrombin time, Clotting time, Bleeding time, Prothrombin time, Partial Prothrombin time, Mechanismof coagulation of blood		
Unit II	**Haemogram, Special Haematological Tests**		
	Haemogram - Haemoglobin, PCV, ESR, RBC count, WBC count, Platelet count, Calculations of Anaemia using MCH, MCV & MCHC, Reticulocyte count, Absolute Eosinophil count, Differential count. Special Hematological tests : Osmotic fragility – Heinz body preparation, Blood parasites – Lupus Erythematosus (LE) Cell preparation – Cytochemical tests, Quality control and quality assessment		
Unit III	**Body Fluids : Properties, Amniotic, Cerobrospinal, Synovial, Serous, Seminal, Sputum, other body fluids**		
	Physical properties :Body fluid compartments, Solutes in body fluid, Clinical abnormalities of fluid volume regulation, Movement of body fluids Amniotic fluid : Formation and function of amniotic fluid, Chemical		

	composition, Collection, Testing – Alpha fetoprotein, Acetyl cholinesterase, Neural tube defects, Chromosomal abnormalities, Haemolytic disease of newborn, Gestation age, Foetal maturation Cerebrospinal fluid :Formation, Specimen collection, Causes of CSF pressure changes, Examination- Gross, microbiological, cytological Chemical analysis, Immunologic tests Synovial fluid : Classification of joint disorders, Non-inflammatory joint diseases –Osteoarthritis, Traumatic arthritis, Neurogenic joint disease. Inflammatory joint disease – Rheumatoid arthritis, Lupus arthritis, Cell count, Chemical and serological examinations, Clinical correlations Serous fluid & other body fluids: Formation, Collection, Classes of effusions, Cell types and clinical correlations. Lymph, Gastric fluid, Urine, Faeces, Seminal fluid, Sputum and sweat, Biomarker evaluation in body fluids for specific therapeutic prognostic and /or diagnostic potential		
Unit IV	**Neurological Disorders, Vitamin Deficiencies**		
	Neurological disorders and Vitamins deficiencies : Alzheimer's disease, autism, Canavan's disease, Parkinson's disease, Carpal tunnel syndrome, Lesch- Nyhan syndrome, Lyme disease,Multiple sclerosis, Wallenberg's syndrome and Werdnig-Hoffman disease. Beriberi, Pellagra, Biotin Deficiency, Scurvy, Rickets, Arabiflavinosis, Vitamin K deficiency, Hypocobalaminemia, Paraesthesia and Night blindness		

M.Voc. (MLT) Part I / PG Diploma – Semester II - Practicals	
Sr. No.	**Experiment**
	MMLT201 (Clinical Techniques & Organ Function Tests)
01	1. Cardiac Function Test : a. Lipid Profile
02	Renal Function Test
	a. Urea
	b. Creatinine
	c. Uric acid
03	Liver Function Test
	a. Total proteins
	b. Bilirubin
	c. SGOT
	d. SGPT
	e. Alkaline phosphatase
	f. Bile pigments
04	Gastric, Pancreatic and Intestinal Function Test
	a. Serum amylase
	b. Serum lipase
	c. Serum insulin level
05	Thyroid and Salivary Gland Functions Test : a. T3, T4, TSH and PTH
06	Adrenocortical Function Test

	a. Estimation of ACTH
	MMLT202 (Clinical Immunology & Immunopathology)
07	Widal Test (Qualitative & Quantitative)
08	RPR (Rapid Plasma Reagin)Test
09	CRP (C Reactive Protein) Test
10	RA (Rheumatoid Arthritis) Test
11	ASO (Anti- Streptolysin O) Test
12	Radial Immunodiffusion
13	Double Immunodiffusion
	MMLT203 (Clinical Pathology, Cytogenetics& Molecular Biology)
14	Methods of Staining (Romanowsky Stain)
15	Determination of Haemoglobin
16	Determination of Coagulation Time
17	Study of Cytogenetic Disorders - Study of Syndromes
18	Construction of Restriction Map
19	DNA Sequencing
20	Polymerase Chain Reaction (PCR)
	MMLT204 (Haematology, Fluid Analysis & Human Disorders)
21	Direct and Indirect Coomb's Test
22	ELISA Test for the Detection of Antibodies to HIV-1 and HIV-2
23	Rapid Detection of Hepatitis B Surface Antigen (HbsAg) by ImmunofiltrationMethod
24	Detection of Hepatitis C Virus (HCV) Antibodies
25	Examination of various body fluids-Pleural Fluid, Pericardial Fluid, Synovial Fluid, Ascetic Fluid

M.Voc. (MLT) Part II – Semester III

Courses Objectives :

The objective of this course is to have a firm foundation of the fundamentals and applications of Community Medicine, Epidemiology, Blood Banking & Histopathology

Learning outcomes :

By the end of the course the student will be able to :

- Understand the significance of Community Medicine
- Understand Risks and apply Preventive Measures and perform diagnosis of epidemics
- Gain knowledge to work as a skilled Technician in Blood Banks
- Gain knowledge and assist in Blood Transfusion Process

Course Code	Title	Credits	NOS
MMLT301	**Community Medicine, Epidemiology & Life Style Disorders**		
Unit I	**Basic Epidemiology**		
	Epidemiology: definition, concepts, uses and its role in health and disease. Use of basic epidemiological toolsto make a community diagnosis of the health situation. Modes of transmission and measures for preventionand control of communicable and non-communicable diseases. Principal sources of epidemiological data.Definition, calculation and interpretation of morbidity and mortality indicators. Need, uses and evaluation ofscreening tests. Application of computers in epidemiology		
Unit II	**Environment and Health**		
	Water: Concepts of safe and wholesome water, sanitary sources of water, waterborne diseases, water purification processes, water quality standards. Physical and chemical standards of drinking water quality andtests for assessing bacteriological quality of water. Concepts of water conservation and rainwater harvesting. Concepts of solid waste and human excreta and sewage disposal. Awareness of standards of housing and the effect ofhousing on health. Health hazards of air, water, noise, radiation pollution.		
Unit III	**Reproductive and Child Health & Health Education**		
	Current status of Reproductive and Child Health. Screening of high risk groups and common health problems. Reproductive child health (RCH) components, including child survival and safe motherhood, Universal Immunization Programme, Integrated Child Development Services Scheme (ICDS), Integrated Management of Neonatal and Childhood Illness (IMNCI) and other existing Programmes. Organization, implementation and evaluation of reproductive and child health program components. Various family planning methods, their advantages and shortcomings. Gender issues and Women empowerment Organizations, technical and operational aspects of the National Family Welfare Programme Approaches in health education. Methods of Health Education. Barriers to effective Communications. Principles of Health Education. International Health Organisations – WHO, UNICEF, Red Cross, Voluntary Health Organisation, International Health Regulations		
Unit IV	**Life Style Disorders : Diseases & Mental Health**		
	Diabetes mellitus, Cardiovascular Problems- Systemic Hypertension and Arteriosclerosis, Neurological Disorders- Epilepsy,Headache, SleepDisorders Alzheimer's Disease,Cancer,Chronic Liver Disease/Cirrhosis, Nephritis and Stroke Stress and Mood disorders, Anxiety disorders, Disruptive Behavior, Psychosis and related disorders, Substance abuse – smoking and alcoholism		

	and other high risk behaviours		
MMLT302	**Endocrinology& Nutritional Biochemistry**		
Unit I	**Endocrinology – Concept, Pathology**		
	Concepts: The endocrine system; hormones- chemical nature;classification; hormonal action- receptors; hormone receptor interaction; regulation of gene expression by hormones; second messengers (camp, GMP, Ca++) Protein kinase cascade; Concepts of hormones assay. **Pathology in Endocrine Systems:** Abnormal Hormone Activity; Endocrine organ hypofunction; Endocrine organ hyperfunction; Abnormality in hormone transport or metabolism; Abnormal hormone receptor binding and/or signal transduction; Neoplasms; Iatrogenic; Assessment of endocrine diseases; Endocrinal imaging		
Unit II	**Glands, Hormones**		
	Hypothalamus and Pituitary Gland: Anatomy; chemistry; functions; regulation; Diseases related to the hormones of these glands; Assessment of anterior and posterior pituitary. **Thyroid Gland:** Anatomy; chemistry; synthesis; functions; regulation; thyroid function test in various abnormal conditions; parathyroid – anatomy; chemistry; synthesis; functions; regulations; diseases of parathyroid glands; Hormones involved in calcium and phosphate metabolism; Diseases related to its metabolism; Calcium chemistry and functions. **Adrenal Cortex and Medulla:** Anatomy; chemistry; synthesis; metabolic effects;pathophysiology of the adrenal cortex; Assessment of adrenal functions; Gonadal hormones – anatomy, chemistry; functions; regulations and diseases related to these glands; Endocrinology of male and female infertility; pregnancy and lactation. **Gastrointestinal and Pancreatic Hormones:** Chemistry; synthesis; metabolic effects; regulation; diseases related to the hormones of these glands; Detection of anomalies		
Unit III	**Nutrition**		
	Nutritional requirements of carbohydrates; proteins and lipids; Deficiency states of carbohydrates, proteins and lipid; Minerals and their role in nutrition; RDA, Nutritional requirements of vitamins (fat and water soluble); Structure, functions, deficiency states, dietary source; Nutritional requirements of macro and microelements-functions, deficiency states, dietary source, RDA		
Unit IV	**Nutrition in Health and Disease**		
	Balanced diet-Regulations of food intake and energy storage; Disorder of nutrition-Malnutrition, malabsorption, obesity, starvation, deficiency diseases		
MMLT303	**Blood Banking & Blood Transfusion**		
Unit I	**Blood Banking**		
	Basic principles of Immunohaemeatology; methods of collection of blood;preparation and labeling of anticoagulant bulbs; human blood groups antigens and antibodies; ABO Blood group systems; sub- groups; source of antigens and types of antibodies; Rh Blood group systems; types of antigens; mode of inheritance; types of antibodies; Other blood group antigens; Blood collection; selection and screening of donor; collection of blood; various anticoagulants; storage of blood; materials and reagents used for different investigations in blood bank; HDN; Quality assurance in Transfusion Service.		
Unit II	**Storage & Transport**		
	Storage of blood ; changes in blood after storage; Gas refrigerator lay out of a blood bank refrigerator; transportation; Compatibility testing: purpose;		

	single tube compatibility techniques using AHG reagent; emergency compatibility testing; difficulties in cross matching; labeling& issuing cross-matched blood		
Unit III	**Blood Group, Transfusionology**		
	Introduction, overview of blood components; collection of blood components for fractional transfusion; platelets packed Red cell, platelet rich plasma, platelets concentrate; preparation of concentrated (packed) red cells; techniques of preparation. knowledge of maintenance and working of Blood bank refrigerators, Welkin coolers, refrigerated centrifuge incubators, ovens, autoclaves etc; Transfusion reactions- recognition and investigations; actions to take when transfusion reaction occurs; criteria used while selecting a blood donor; Special investigations in Transfusion technology		
Unit IV	**Blood Bank Records**		
	Blood donation record book; recording results; blood donor card; blood bank temperature sheet; blood bank stock sheet; blood transfusion request form; Quality control in blood banks- specimen collection; risk assessment for AIDS and serum hepatitis.		
MMLT304	**Histopathology & Modern Diagnostics**		
Unit I	**Histopathology**		
	Introduction & importance of histopathology -Branches of Histopathology, Organisation of Histology Laboratory; Histology equipment, Specimen Reception; Method of specimen collection - Types of Biopsy Procedures, Examination of Tissues and Cells; Automation in Histopathology - New Generation Microtome, Tissue Processing, Embedding, Station, Tissue-Tek, Image Analysis, Stainers and Cover Slippers; Use of Microwave Oven		
Unit II	**Tissue Processing & Staining**		
	Tissue Fixative - Simple Fixative and their properties; Micro anatomical fixative - Histochemical fixatives. Tissue Processing; Decalcification - Determining the End-point of Decalcification, Neutralization and Processing; Embedding - Microtome, Microtome Knives, Section Cutting and Mounting on Slide; Frozen Section - Cryostat. Types of staining – H and E Staining, Mounting of Sections, Periodic Acid Schiff (PAS), Feulgen Stain, Masson's Trichrome, Giemsa Stain, Phosphotungstic Acid-haematoxylin Stain, The Papanicolaou Stain; Stains for : Pigments, microorganism, parasites, carbohydrate, lipids, Nucleic Acid		
Unit III	**Cervical Cytology &Kidney Transplantation**		
	Overview of Cervical Cytology - Pap Test- Method, Collection and Transportation, Causes for Rejection of Specimen or Limited Reports; Results of Pap Test - Aspects of Pap Test, Effectiveness of Pap Test, Practical Aspects of Pap Test; Bethesda System - Types of Results, Squamous Cell Abnormalities, Bethesda System 2001 for Cervicovaginal Cytology Reporting, Carcinoma - Hormonal assessment, Cytological techniques, Special collection method, Clinical applications. Kidney transplant - Tissue typing; Mixed Lymphocyte Reaction - Tissue typing techniques, Minor Histocompatibility antigen		
Unit IV	**Recent Advances in Cytopathology**		
	Fine Needle Aspiration Cytology (FNAC); Thin Layer Cytology &Immunofluorescent Techniques - Thin Layer Cytology, Immunofluorescent Techniques, Flow cytometry; Advances in Lung Cytopathology - Advances in Cytopathology for Lung Cancer, Advances in Urinary Cytopathology, Advances in Cytopathological Evaluation of Lymphomas; New Techniques for Obtaining Samples for Cytopathological Examination - Automation in		

	Cytology		

M.Voc. (MLT) Part II – Semester III - Practicals	
Sr. No.	**Experiment**
	MMLT301 (Community Medicine, Epidemiology & Life Style Disorders)
01	Study of Morbidity and Mortality Indicators (Calculations and interpretation)
02	Study of Physical Standards of Drinking Water
03	Study of Chemical Standards of Drinking Water
04	Determination of bacteriological quality of water
05	Study of Mental Health Disorders
06	Physical Fitness and Assessment Tests- BMI, BMR, Skin folds Measurement, Pulse Rate, Blood Pressure
	MMLT302 (Endocrinology & Nutritional Biochemistry)
07	Study of Glands
08	Study of Nutritional Requirements - RDA
	MMLT303 (Blood Banking & Blood Transfusion)
09	Blood Group Detection – ABO Blood Grouping & Rh Factor
10	Compatibility Testing – Cross Match
11	Study of Blood Components
12	Study of Advanced Equipments in Blood Bank
13	Maintenance of Blood Bank Records
	MMLT304 (Histopathology & Modern Diagnostics)
14	Microtome &Tissue Processor
15	Fixatives
16	Tissue Processing
17	Section Cutting
18	Slide Preparation, Staining and Mounting
19	Cervical Cytology- Pap Test
20	Recent Advances in cytopathology

M.Voc. (MLT) Part II – Semester IV

Courses Objectives :

The objective of this course is to have a firm foundation of the fundamentals and applications of Forensic Science, Modern Diagnostics & Techniques, Instrumentation, Hospital & Laboratory Management, Laboratory Accreditation & Certification Process, Clinical Practices & Research in Paramedicals.

Learning outcomes :

By the end of the course the student will be able to :

- Study, understand the field of Forensic Science and applications of it
- Learn Modern / Advanced Diagnostic Techniques
- Apply knowledge of Hospital & laboratory Management
- Understand the process of Hospital & Laboratory Accreditation and Certification Process
- Learn Methodology in Clinical Research

Course Code	Title	Credits	NOS
MMLT401	**Forensic Science, Pharmaceutical Chemistry, Toxicology**		
Unit I	**Forensic Pharmacology**		
	Pharmacology and its branches, Forensic Pharmacological studies, absorption, distribution, pharmokinetic, metabolic pathways of common drugs and poisons, Drug toxicity, excretion of drugs and poisons, method of extraction, isolation, identification of metabolites. Metabolites of methanol and ethanol, acetyl salicylate, DDT, Parathion, carbaryl, phenobarbitone, diazepam, amphetamine and heroin motobolite identification by GC- Mass and LC-Mass		
Unit II	**Forensic Toxicology**		
	Introduction and scope of forensic toxicology. Different types of poisons commonly encountered. Different routes of ingestion, toxicity of poisons. Fate of drug in body. Samples in fatal and non- fatal cases. Packing andpreservations of viscera. Extraction and screening of common poisons and methods of analysis of poisons. Forensic toxicology of Ethyl alcohol. Determination of alcohol in field by breath analyser		
Unit III	**Drug: Drug, Designing & Screening**		
	Classification and nomenclature, some medicinally important inorganic and organic compounds and their biological role. Pharmaceutical aids: organic pharmaceutical aids preservatives, stabilizing and suspending agents, ointment bases and related agents and solvents Biological testing of drugs: testing drugs in-vitro enzyme inhibition, receptor studies, safety and efficacy, microbiological testing, screening and testing by NMR , testing drugs in vivo: test systems drug potency, therapeutic ratio.Use of cell lines and animal models.Placebocontrolled studies. Safety evaluations, followed by efficacy studies		
Unit IV	**DNA Profiling**		
	DNA typing systems- RFLP analysis, PCR amplifications, sequence polymorphism. Analysis of SNP, Y- STR. Mitochondrial DNA, evaluation of results, frequency estimate calculations, interpretations, allele frequency determination, match probability- database, qualitycontrol, certification and accreditation Applications in disputed paternity cases, child swapping, missing person's identity- civil immigration, veterinary, wildlife and agriculture cases, The Combined DNA Index System (CODIS), legal perspectives- legal standards for admissibility of DNA profiling, procedural and ethical concerns, New		

	and future technologies: DNA chips, SNPs and limitations of DNA profiling.		
MMLT402	**Modern Diagnostics - Separation Techniques, Non-invasive Techniques**		
Unit I	**Centrifugation & Chromatography**		
	Centrifugation : Basic principles, procedure and working mechanism – Different methods of centrifugation techniques (Differential, density gradient – Zonal and isopyenic and ultra centrifugation) Chromatography :Methods, Principles, Instrumentation and working mechanism: Chromatographic techniques: paper, thin layer and column chromatography, Gel, Ion and affinity Instrumentation of GC and HPLC, applications in qualitative and quantitative analysis, comparison of GC and HPLC		
Unit II	**Electrophoresis**		
	Theory, types: moving boundary and zone electrophoresis, paper and polyacrylamide gel electrophoresis. SDS-PAGE- and their applications. Isolation of DNA and RNA – Agarose gel electrophoresis and its applications. Blotting techniques (Southern, Northern and Western), PCR techniques and their applications		
Unit III	**Medical Imaging**		
	Medical Imaging : Biopotential electrodes- Basic medical instrumentation system- Radiation- X-Ray –Fundamentals of X-ray, Generation and Detection of X -rays, X-ray Diagnostic Methods- Dual energy X ray Absorptiometry, Electroencephalography, Recording - Electrocardiography- Stress testing- tread mill test- Electromyography and nerve conduction studies **Nuclear medical imaging** : Fundamentals of radioactivity, Computed Tomography: Basic principles, diagnostic methods - Positron Emission Tomography - Single Photon Emission Computed Tomography		
Unit IV	**NMR, Opthalmology, Mammography**		
	Fundamentals imaging- of Nuclear Magnetic Resonance, Imaging Fundamentals of Acoustic Methods, Magnetic Ultrasonic Resonance Diagnostic Ultrasonography- Propagation, Methods- Transcranialdoppler studies Opthalmology : Visual acuity test- Fluorescein angiography- Opthalmoscopy- Electroretinography, Oculoplethysmography- Oculopneumoplethysmography- Evoked potential studies Mammography- conventional mammography, digital mammography- virtual and conventional colonoscopy- angiography- coronary angiography, microangiography- fluoroscopy and Thermography.		
MMLT403	**Hospital & Laboratory Management, Modern Clinical Practices & Ethics**		
Unit I	**Management : Principles, Practices & HR**		
	Basic concepts of Management: Definition, functions of management, Planning, organizing, directing, controlling and coordinating and decision making. Organizational behaviour - personality and attitudes, motivation, formation of teams and team work Career Planning, Promotion Policies. Wage and Salary Administration, Employee Benefits and Social Security, Performance Appraisals. Issues Relating to Management of Professionals, Consultants, Specialists, Medical Officers, Nursing Staff, Other Paramedical Staff		
Unit II	**Material Management & Inventory Control**		
	Materials Planning - Classification of Materials: Consumables, Non consumables, Budgeting. Purchase Management: Objectives, Purchase		

	system, Purchase Procedures, Selection of Suppliers and Store management Classification of inventory, Techniques of inventory Control. Computerization of inventory transactions, Sub-stores in variousdepartments, Physical stock taking. Medical Stores – Functions, Storage condition/Monitoring, Expiry dates and action, Role of drug Review Committee		
Unit III	**Clinical & Non-Clinical Services, Accreditation**		
	National Health Policy, National Health Programmes, Hospital Accreditation, Role of Quality Council of India (QCI), National Accreditation Board of Hospitals (NABH), NABL160, ISO15189:2007. Clinical and non – clinical services: Radiology Services, Pathology and Clinical Laboratory, Central Sterile Supply Department, Laundry and Linen Services, House Keeping Services, Disposal of Biomedical Waste, Medical Records Department, Maintenance of Building, Campus and Utilities and Fire safety		
Unit IV	**Reproduction, Bioethics &Contemporary Ethical Issues**		
	Personhood – Abortion – Bioethical issues in reproduction,population explosion and control – Assisted reproduction – Egg donation – Prenatal screening and sex selection – Cloning- Ethical issues on life & death – Brain Vs Cortical death – Persistent vegetative state – Voluntary euthanasia and physician assisted suicide		
MMLT404	**Research Methodology & Biostatistics**		
Unit I	**Research Methodology- General Aspects**		
	Identification of areas of research field- problems and needs for experimental approach, Good laboratory practices. Review of Literature - biological and medical abstracts, current contents, CD Rom, Internet,Website, Citation Index- Peer- reviewed publications. Selection of suitable methodology and statistical techniques for controlled and unbiased experimentation – designing of experiments. Guidelines for analysis and discussions – preparation of the manuscript for scientific publications, ethics in research		
Unit II	**Research Methodology- Project Proposal**		
	Project proposal-Thrust areas-Funding agencies (National andInternational) – Kinds of research program in India and abroad; Career development in laboratory research.- Impact factors, principle and method of patenting		
Unit III	**Biostatistics – Descriptive Statistics, Correlation & Regression**		
	Descriptive statistics – Diagrammatic representation, Measures of location, Measures of dispersion, skewness and Kurtosis Correlation and regression- Bivartive frequency table – Rank correlation – Multiple linear Regression		
Unit IV	**Biostatistics – Statistical inference, Significance Tests, Analysis of Variance**		
	Statistical inference – Point and interval estimation, Hypothesis testing, Test for assigned proportion, Equality of proportions, Assigned mean, Equality of means. Chi – Square test for goodness of fit, Contingency table, test for independence of two attributes. Analysis of variance –One way classification, Two way classification		

M.Voc. (MLT) Part II – Semester IV- Practicals	
Sr. No.	**Experiment**
	MMLT401(Forensic Science, Pharmaceutical Chemistry, Toxicology)
01	Extraction , Screening and Analysis of common poisons
02	Determination of alcohol by Breath Analyser
03	Biological Testing of drugs – In vitro enzyme inhibition
04	Biological Testing of drugs – Microbiological Testing
05	Detection, handling, measurement and disposal of body and tissue containing radioactive material
06	DNA Typing
07	Applications of DNA Profiling in disputed cases
	MMLT402 (Modern Diagnostics - Separation Techniques, Non-invasive Techniques)
08	Applications of Chromatography in qualitative and quantitative analysis (GC/HPLC)
09	Applications of Agarose Gel Electrophoresis (AGE)
10	Applications of Polyacrylamide Gel Electrophoresis (PAGE)
11	Applications of Blotting Techniques – Southern, Northern and Western
12	X-ray Diagnostic Method – Generation and Detection of X-Rays
13	Electrocardiography & Stress Test
14	Ultrasonography Test
15	Opthalmoscopy Test
16	Angiography Test
	Hands-on Project Training: It is mandatory for students to undergo Hands-on Project training in a established Laboratory, Hospital, Diagnostic Centre for 4-6 months; This should involve relevant instrumentations & techniques. Thesis on the same to be evaluated by the guide alternatively by the internal examiner for 50M based on the students performance, written matter and experimentation. A certificate/ marklist to be appended with the thesis. External Examiner to assess for 50M as a Presentation during practical exams. Marks allotted by Internal Examiner would be scaled down if required as per university guidelines.

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Semester I	
	MMLT101 (Fundamentals of Medical Laboratory Technology)
1	Mukerjee, K. L. and S. Ghosh, 2010. Medical Laboratory Technology, Volume I, McGraw Hill, New Delhi
2	Sood.R., 2006. Textbook of Medical Laboratory Technology, Jaypee, New Delhi
3	Fischbach, F.T. and M.B. Dunning, 2009. A Manual of laboratory and Diagnostic Tests, Lippincott Williams Wilkins, New York
4	Sonnenwirth, A.C. and L. Jarret, 2000 Gradwohls' Clinical laboratory methods and diagnosis. M.D.B.I.,New Delhi
5	Ochei, J. and A. Kolhatkar, 2000. Medical Laboratory Science, Theory and Practice, McGraw Hill, New Delhi
	MMLT102 (Principles of Biochemistry & Clinical Biochemistry)
6	Biophysical Chemistry, By James P. Allen, 2009
7	Textbook of Biophysical Chemistry, By U.N. Dash, 2006
8	The Physical Basis of Biochemistry: The Foundations of Molecular Biophysics, By Peter R.Bergethon, 2010
9	Chernecky, Cynthia C. and Barbara J. Berger. Laboratory Tests and Diagnostic Procedures, 3rded. Philadelphia, PA: W.B. Saunders Company, 2001
10	Kee, Joyce LeFever. Handbook of Laboratory and Diagnostic Tests, 4th ed. Upper Saddle River, NJ: Prentice Hall, 2001
11	Henry, John B., ed. Clinical Diagnosis and Management by Laboratory Methods, 20th ed. Philadelphia: W.B. Saunders Company, 2001
	MMLT103 (Human Anatomy & Physiology)
12	Guyton A.C and J E Hall, A text book ofMedicalPhysiology,W.B Saunders,1996
13	Talwar,G.P.andC.M.Srivastava, A text book of Biochemistry and Human Biology.Prentice Hall of India Ltd.,2003
14	Human physiology fromcells to systems, 5th edition 2004, LauraleeSherwood,Thomson. Asia Pvt.Ltd. Singapore
15	Physiology, RobertM.Beenu,Mathew N Levy, BruceM.Koeppem, A.Stanton, 5thEdition Mosby 2004
16	Elaine N, Benzamin, Human anatomy and physiology, 3rd edition, Cammings publishing company, 1995
	MMLT104 (Medical Parasitology, Mycology & Virology)
17	Chatterjee, K.D.,2009. Parasitology,CBS, Chennai
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19	Alexopoulus, C.J and C. W. Mims, 1993. Introductory Mycology. Wiley Eastern Ltd, New Delhi
20	Brooks, G.F., S. Morse, K.C. Carroll, J.Butel, 2010. Jawetz, Melnick, and Adelberg's Medical Microbiology, McGraw Hill, New Delhi

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22	Dubey, R.C. and D.K. Maheswari, 2005. A text book of Microbiology, S.Chand, New Delhi
23	Landecker, E.M.,1996. Fundamentals of the Fungi, Prentice Hall International, London
24	Pelczar, M. J., E. C. S. Chan and N.R. Kreig, 2006. Microbiology, Tata McGraw Hill, New Delhi
25	Powar, C. B and H.F. Daginawala, 2005. General Microbiology, Vol.I& II, Himalaya Publishing House,Mumbai
26	Salle, A.J., 2001. Fundamentals & Principles of Bacteriology. McGraw-Hill, New Delhi.

References	
Semester II	
	MMLT201(Clinical Techniques & Organ Function Tests)
1	Griffin, J.E. and Ojeda, S.R. (Eds.), “Textbook of Endocrine Physiology”, New York: OxfordUniversity Press
2	Baulieu, E.E. and Kelly, P.A. (Eds.), “Hormones: from molecules to disease” New York:Chapman& Hall
3	C. Martin H. Steinberg: Disorders of Hemoglobin: Genetics, Pathophysiology &ClinicalManagement: Cambridge University Press
	MMLT202 (Clinical Immunology & Immunopathology)
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	MMLT301 (Community Medicine, Epidemiology & Life Style Disorders)
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2	Hiremath, D.A., 2004. Essential of community medicine and practical approach , Jaypee, New Delhi
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7	Dhaar, G.M.,and I. Robbanni, 2008. Foundations of Community Medicine, Elsevier,NewDelhi
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9	Baulieu, E.E. and Kelly, P.A. (Eds.), "Hormones: from molecules to disease" New York: Chapman & Hall
10	C. Martin H. Steinberg: Disorders of Hemoglobin: Genetics, Pathophysiology & Clinical Management: Cambridge University Press
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	MMLT403 (Hospital & Laboratory Management, Modern Clinical Practices & Ethics)
23	Malhotra, A.K., 2009. Hospital management: An Evaluation, Global India, New Delhi
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25	Aswathappa, K., 1998. Human Resource and Personnel Management, Tata McGraw Hill, New Delhi
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29	Sharma, M., 2000. Essential of Hospital Support Services and Physical Infrastructure. Jaypee , New Delhi
	MMLT404 (Research Methodology & Biostatistics)
30	Bradford Hill, S.A., A Short Textbook of Medical Stastics. The English Languagebook and hodder and Stoughton, London. 1981
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Eligibility Criteria:-

<table>
<tr><td rowspan="5">Master of Vocation in Medical Laboratory Technology M.Voc.(M.L.T)</td><td></td><td colspan="3">Admissions will be on merit (percentage of aggregate marks/ grade secured at the qualifying examination).
Reservation criteria will be followed as prescribed by the government at the time of admissions.
The admission should be strictly on merit for the seats allotted by the University.
While drawing the merit list, weightage to be given as below:</td></tr>
<tr><td colspan="2">MAJOR</td><td>Weightage</td><td>ANCILLARY</td></tr>
<tr><td colspan="2">B.Voc. (M.L.T.)</td><td>50%</td><td>----</td></tr>
<tr><td colspan="2">B.Sc. (Life Science/ Zoology/ M.L.T./ Biomedical Sciences/ Microbiology/ Biotechnology/ Biochemistry/ Applied or Allied Biological Sciences)</td><td>40%</td><td>Chemistry up to Second Year B.Sc.</td></tr>
<tr><td colspan="2">Bachelor in Pharmacy</td><td>5%</td><td>----</td></tr>
<tr><td colspan="2">Bachelor’s Degree in Medicine (M.B.B.S. / B.D.S. / B.A.M.S. / B.H.M.S./ B.P.T.,/ B.O.T.)</td><td>5%</td><td>----</td></tr>
</table>

The applications are to be accepted and processed by the college stream wise separately and merit list will be displayed stream wise taking into account the reservation policy prescribed by the Government of Maharashtra.

a) The merit list is to be prepared and displayed stream wise.
b) In case, if no applications are received or if the seats remain vacant under“Pharmacy” and “Bachelor’s Degree in Medicine” after all the merit lists / forms are exhausted, the vacant seats must be transferred equally between B.Voc.(MLT) and B.Sc. courses.
c) After the first merit list is displayed, if any seat allotted to one stream remains vacant, the same shall be distributed equally between the remaining streams. In case of vacancy in one stream is of single/odd number of seats, the single seat is to be allotted to the B.Voc(MLT).
d) Step (c) be repeated for the subsequent merit lists till all the forms are exhausted or the final merit list is displayed, whichever is earlier.

UNIVERSITY OF MUMBAI

Sr. No.	Heading	Particulars
1	Title of the Course 0.6619	Master of Vocation (Medical Laboratory Technology) **(M.Voc. M.L.T.)**
2	Eligibility for Admission 0.6620	B.Voc. (MLT) /B.Sc.(MLT.)/ B.Sc.(Life Science/ Zoology/ Biomedical Sciences/ Microbiology /Biotechnology/ Biochemistry/ Applied or Allied Biological Sciences)/ B. Pharmacy / Bachelor's Degree in Medicine (M.B.B.S./ B.D.S./ B.A.M.S./ B.H.M.S./B.P.T./B.O.T.)
3	Passing Marks	40%
4	Ordinances / Regulations (if any)	--
5	No. of Years / Semesters	02 years (04 semesters)
6	Level	√ P.G. / U.G./ Diploma / Certificate **(Strike out which is not applicable)**
7	Pattern	Yearly / **Semester √** **CBCS (Strike out which is not applicable)**
8	Status	**√ New** / Revised **CBCS (Strike out which is not applicable)**
9	To be implemented from Academic Year	From Academic Year 2020-21 **in Progressive manner**.