

MAHARASHTRA UNIVERSITY OF HEALTH SCIENCE , NASHIK
POST GRADUATE DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY
(PG DMLT) COURSE

SYLLABUS

Candidate with D.M.L.T. qualification are expected to work as technicians in laboratories attached to hospitals under supervision of a senior officer like Biochemist, Microbiologist or Pathologist. They may be employed in a small laboratory functioning independently or attached to a doctor's clinic.

Nature of their job dictates that candidates should give more emphasis on learning of practical skills and behavioral skills along with a basic knowledge of the subject.

I. Eligibility : -

Candidate must have passed B.Sc. Degree of statutory/ recognized University with Chemistry, Biochemistry, Microbiology, Biotechnology, Botany and Zoology as principle subject.

II. Admission and Duration :

Admission to the course should be done once in a year. The course should be a full time course commencing from the July every year.(i.e. After declaration of B.Sc. Result of all non agriculture Universities.

The examination shall be held at end of the course, i.e. after completion of two academic terms. The candidate who has passed in all the three subjects Biochemistry, Microbiology and Pathology as per the provisions, MUHS, Nashik. shall award DMLT to successful candidates

III. Examination Pattern:

The examination shall be held for three subjects of 600 marks. The breakup shall be as follows :

Subject	Theory of 3 Hours duration	Practical and Viva Voce
Paper I (Clinical Biochemistry)	100	100
Paper II (Microbiology)	100	100
Paper III (Pathology)	100	100
Total	300	300

Theory examination for three subjects shall be conducted on separate days. Practical and Viva voce examination for all the three subjects will be conducted on three consecutive days.

Standard of Passing the Examination :

(a) To pass the examination a candidate must have obtained not less than 50% marks in each head of passing i.e. theory and practical including viva – voce examination separately simultaneously.

(b) Exemption :

If a candidate has passed in both the theory and practical heads of one or two subjects i.e. Bio-chemistry or Microbiology or Pathology he / she shall be eligible to get exemption for that subject/s and will be required to appear only for the subject/s in which he/she has failed.

IV. Board of Examiners and Mode of Assessment : It shall consist of six examiners by appointing one - internal and one external examiner from each discipline (i.e. Pathology, Microbiology and Biochemistry).

Internal Examiner by rotation shall be appointed as Chairman of the Board of Examiners for coordinating examination work.

The examiners will act as paper-setters and carry out the assessment of theory papers and practical and viva-voce examination in respective subjects.

Both examiners for respective subject will assess theory papers and submit their individual mark lists to the Chairman. The Chairman shall prepare final mark list for each subject by taking average of both mark lists for respective subject.

Clinical Biochemistry : Theory Portion :

(a) **Introduction** : Role of technician in the laboratory. Importance of Clinical Biochemistry in medical field.

(b) **Basic concepts of Biochemistry** :

(These concepts should be dealt in brief, focussing on clinical relevance wherever applicable.)

1. Carbohydrate.-.. Definition, classification, functions,properties, Osazone formation.
2. Proteins and amino acids: Definition, classification, functions, chemical reactions of proteins & amino acids.
3. Nucleic acids : Definition, types, functions.
4. Lipids : Definition, classification, functions of lipids and lipoproteins.
5. Enzymes : Definition, classification, factors affecting enzyme action, inhibition, diagnostic importance of enzyme and isoenzymes.
6. Carbohydrate metabolism : Definition and importance of Glycolysis, Glycogenesis, Glyco-genolysis, Gluconeogenesis, Krebs's cycle, Cori's Cycle. Blood glucose regulation, Glycosuria. Glucose tolerance tests
7. Protein metabolism : Deamination and Transami-nation. Urea formation, Creatine metabolism.

8. Lipid metabolism : Definition and importance of Beta oxidation of fatty acids, functions and clinical importance of Triacylglycerol, Phospholipids and Cholesterol-Lipid profile & its importance
9. Mineral metabolism : Functions and metabolism of Calcium, Phosphorous. Sodium. Potassium. Iodine and Iron.
10. Blood : Composition, functions and separation of plasma proteins, Blood coagulation. Chemistry and functions of haemoglobin including porphyrin and bilirubin metabolism.
11. Acid base balance : Definition and importance of blood pH and its maintenance by buffers, Respiratory and renal mechanism, Acidosis and alkalosis (in brief).
12. Metabolis disorders : Diabetes Mellitus, Atherosclerosis,
13. Analytical instruments & techniques
Principle, types, uses , care & maintainance of
 - a) Photoelectric colorimeter, spectrophotometer ,flame photometer
 - b) Chromatography
 - c) Electrophoresis
14. Automation in clinical Biochemistry
Principle, types, uses of Autoanalyser ,Blood Gas analyzer & role of computer in laboratory

(c) Practical Aspects for Clinical Biochemistry:

1. Laboratory management and planning: Reception and recording of specimens, maintenance of laboratory records, reporting.
2. Specimen collection : Whole blood, plasma, serum, urine, C.S.F & other body fluids, preservation of specimens, anticoagulants.
3. Quality Control: Role of quality control and its importance. Accuracy, Reliability, Precision. Internal and external quality control measure, preparation of reagents, standardization of methods, safety measures and precautions.
4. Basic laboratory equipment's : Types, use, care and maintenance of following equipment : Ovens, Incubators, Refrigerators, Deep freezer. Centrifuges, Waterbaths, Water distillation ,Analytical Balances, microscopes.
5. Glasswares : Types, use, care and maintenance of flasks, pipettes, cylinders, funnels, tubes, thermometers.
6. Analytical instruments and techniques : Principles, types, use, care and maintenance of photoelectric colorimeters, spectrophotometers, flamephotometers, electrophoresis, Chromatography, Elisa and RIA, isotopes.
7. Biochemical test profiles : Principle and use of Glucose tolerance test, liver function tests, kidney function tests, Thyroid Function Test.

Practical Course: -

Group A : Preparation, Standardization and estimation of following constituents in blood : Glucose, urea, uric acid, creatinine, proteins (total proteins, A/G ratio), S.G.P.T., S.G.O.T., alkaline phosphatase.

Group B : Estimation of following constituents in blood : (i) Acid phosphatase, Amylase, bilirubin, calcium phosphates, Na, K, Cholesterol, Triacyl glycerol, prothrombin time. (ii) C.S.F. (estimation of glucose, proteins, chlorides). (iii)Urine analysis.

Group C: Spots: Colour and precipitation reactions of proteins, instruments and appliances, reagents, tests, electrophoresis, chromatography separation, G.T.T. curves.

V. Laboratory Training and Rotation :

Each candidates shall undergo training in laboratories, of all the three subjects.

Minimum duration of training in each subject shall be of clear 90 days (i.e. excluding Holidays etc.).

This period shall be utilized to help the candidates in learning practical and behavioral skills. All the candidates will be divided into three batches. Then each batch will undergo training in the three laboratories by rotation. Each candidate has to keep a record of his/her work during training period. This period of training shall be utilized for helping the candidates to learn the following :

1. Preparation and preservation of various reagents, stock standard solutions, buffer solutions, anticoagulants for agulant solutions and bulbs for sample collection.
2. Use, care and maintenance of basic equipments, instruments and glass wares.
3. Collection of samples of patients, receiving and registering the samples from wards.
4. Processing, recording and reporting of results.
5. Interpersonal relations and communication with doctors, nurses, wardboys, patients, colleagues and superiors.

VI. Pattern of Examination in Clinical Biochemistry :

(A) Theory Examination : There shall be one paper of 100 marks. The duration of paper should be 03 hours. The paper shall consist of six questions as follows :

- a) Four full questions15 marks each $15 \times 4 = 60$
- b) Two questions on short notes $05 \times 04 = 20$ marks each $20 \times 2 = 40$

(four out of five notes to be attempted in each question)

(Every Short Note carry 05 marks)

(B) Practical and viva-voce examination : 100 marks It shall be conducted as follows :

Exercise A : Standardization and Quantitative Estimation (from Group A): 40 marks

Exercise B : Quantitative Estimation & Urine analysis : (from group B) 25 marks

Exercise C : Spots. 10 marks

Viva-Voce (on theory syllabus) & Journal 25 marks (Viva 20 marks & Journal 05)

Note- For quantitative exercises, flow charts for procedure shall be provided.

MICROBIOLOGY

Pattern of Theory Paper .:

The questions should be technique oriented. It is more important for the candidate to know how to reach final identification of an organism, rather than be able to discuss clinical aspects of the disease.

Portion for Theory :

1. Laboratory Management and Planning. The reception and recording of specimen, cataloguing and indexing maintenance of laboratory records.
2. A knowledge of working and maintenance of the following Incubators, Refrigerators, Water baths, Ovens, Steamers, Autoclaves, Inspissator, Centrifuges, Vaccum Pumps, Water Steel. Cleaning and sterilization of syringes and needles. Simple glass wares.
3. Sterilization : Methods of sterilization and their uses. Chemical, dry heat, steam sterilization, Tyndalisation, filtration, sterilization by ultra-violet light.
4. Care and use of microscope. Dark ground illumination, fluorescence and microscopy.
5. Common bacteriological staining techniques.
6. Cultural Methods: Preparation and sterilization of media. Inoculation and examination of inoculated plates. Antibiotic sensitivity testing, basic techniques of plating and preparation of antibiotic discs.
7. Systemic Bacteriology : The general principles of the methods employed in identifying an unknown organism. Elementary knowledge of common pathogenes. Technique oriented examination of specimens such as pus, urine, stool, sputum, throat swab.
8. Parasitological techniques and elementary knowledge of life cycle and lab. diagnosis of common parasites.
9. Introduction to virology techniques.
10. Miscellaneous : Methods of preservation of cultures, maintenance of stock cultures, disposal of infected material and culture media.
11. Serological Methods : Methods of performing agglutination, complement fixation, precipitation tests. General knowledge of antigen antibody reactions.
12. Mycology as related to Candida and Dermatophytes.
13. Animal House Keeping care feeding and breeding of common laboratory animals as mice, rats, rabbits, guineapigs.
14. Bacteriological examination of food and water.

PRACTICAL COURSE

The candidates should—

1. be able to identify common Gram positive and Gram negative organism by the routine methods from clinical samples.
2. be able to prepare commonly used media and identify them.
3. be able to do a routine stool examination and identify common parasites.
4. be able to do common serological tests in the laboratory e.g. Agglutination tests, e.g. Widal, and latex (Passive) Agglutination based serological test and precipitation tests like VDRL.
5. They should be able to identify and know the working of commonly used equipment in the Microbiology laboratory.

Pattern of Examination :A) Theory Examination: There shall be one paper of 100 marks. The duration of Paper should be 03 hours. The paper shall consist of six questions as follows :

a) Four full questions 15 marks each $15 \times 4 = 60$

b) Two questions on notes 05 x 04 = 20 marks each $20 \times 2 = 40$

(four out of five notes to be attempted in each question)

(Every short Note carry 05 marks)

(B) Practical and viva-voce examination : 100 marks It shall be conducted as follows

Q.1. Long exercise on bacteriology 40 marks which include—

Gram staining 5 marks

Plating technique 5 marks (candidate to observed)

Results 5 marks

Biochemicals - IMVIC, ureas, sugars, oxidase, catalogue and interpretation and

Slide agglutination 15 marks

Antibiotic sensitivity 10 marks

testing-

Q.2. Media preparation 10 marks

Q. 3. Serology exercise 15 marks

Febrile agglutination tests e.g. Widal, Brucells, VDRL and Latex (Passive), Agglutination based test.

Q. 4. Stool examination of parasites, saline

and Iodine preparation 10 marks

Candidate should show 2 abnormalities. Stool must have cysts of amoeba, giardia, at least ova of roundworm, hookworm, whipworm.

Q. 5. Viva and journal 25 marks (20 marks for Viva &
05 marks for Journal)

PATHOLOGY

Theory :

1. Management and planning of the laboratory records.
2. Care and maintenance of laboratory instruments in general. Collection of specimens for laboratory investigations, the importance and significance of laboratory investigations.

A) Histopathology:-

1. Laboratory management and planning, receiving and recording of specimens, indexing, maintaining records.
2. Knowledge of maintenance and use of the following : Microscope, Automatic tissue processor, vacuum embedding bath, microtomes (various types with working of each), hot plates, refrigerators, cryostat.
3. Tissue processing —details of paraffin embedding, vacuum embedding.
4. Decalcification.
5. Section cutting and different types of microtomes.
6. Frozen section — uses and techniques.
7. Theory and principles of different staining procedures in Histopathology.
8. Histochemistry.
9. Structure and function of vital organs like liver, spleen, kidney, heart, brain etc. in short.
10. Museum methods — mounting of specimens, preparation of mounting medium, sealing the jars.
11. Various medicolegal procedures maintaining records.

B) Clinical Pathology and Haematology:

1. Blood — structure and function Haemopoiesis.
2. Collection of haematological specimens, principles and procedures of staining methods in haematology.
3. Erythrocyte — .normal structure and functions. Anaemias Definition, classification, general plan of investigations.
4. Different methods of estimation of hemoglobin.
5. Salient features and investigations for iron deficiency anemia megaloblastic anaemia and haemolytic anaemia.
6. Study of peripheral blood smears.
7. Leukocytes—Normal morphology and functions. Leukocyte disorders, leukoemoid reactions.
8. Leukaemias—Definition, classification, salient features and diagnosis.
9. Haemostasis—Normal and abnormal conditions (haemorrhagic disorders).

10. Investigations in haemorrhagic disorders.
11. Examination of stool.
12. Urine—its formation, normal and abnormal constituents.
13. Renal function tests.
14. Examination of sputum.
15. Examination of body fluids—pleural, pericardial, ascitic. cerebrospinal fluid and semen examination.
16. Liver function tests.
17. Gastric analysis.

C) Transfusionology :

1. Blood bank management and planning the receiving and recording of blood samples, indexing, maintaining blood bank records. Legal aspects in starting and running of a blood bank.
2. Knowledge of maintenance and working of B.B. refrigerators, Walkin coolers, refrigerated centrifuge incubators, ovens, autoclaves etc.
3. Inheritance and nomenclature of ABO and Rh blood group systems, other blood group systems, principles of blood banking.
4. Transfusion reactions—recognition and investigations.
5. Criteria used while selecting a blood donor.

PRACTICAL :

1)HISTOPATHOLOGY :

1. Preparation of paraffin blocks (including the complete processing).
2. Section cutting from a paraffin block.
3. Preparation of a frozen section using a cryostat and a freezing microtome.
4. H and E staining, preparation of stain solutions.
5. Special staining procedures like P.A.S., Reticulin, Masson Trichrome, mucicarmine, congo red, stain for A. F. B.
6. De calcification.
7. Identification of vital organs like liver, spleen, kidney, heart, brain etc. on gross and microscopic examination.
8. Demonstration of medico legal post mortem, methods of preservation of viscera.

CLINICAL PATHOLOGY AND HAEMATOLOGY :-

1. Methods of collection of blood.
2. Preparation and labeling of anticoagulant bulbs.
3. Preparation of various stain solutions.
4. Preparation of blood smears and staining them using different stains.
5. Hemoglobin estimation -different methods.
6. RBC count
7. WBC count
8. Platelet count
9. Estimation of E.S.R.
10. P.C.V.
11. Calculating absolute values.
12. Study of peripheral blood smear in different types of anaemia.
13. Reticulocyte count.
14. Test for sickling.
15. Osmotic fragility test.
16. Detection of foetal haemoglobin.
17. Haemoglobin electrophoresis.
18. Differential W.B.C. count and buffy coat preparation.
19. Study of P.B.S. in different types of leukemia.
20. Cytochemical stains for leukemias.
21. Bleeding and clotting time.
22. Prothrombin time.
23. Partial thromboplastin time with Kaolin.
24. Thromboplastin generation time.
25. Routine, naked eye and microscopic examination of stool and study of parasitic ova and cysts in the stool.
26. Routine physical, chemical and microscopic examination of urine.
27. Demonstration of normal and abnormal findings in pleural, pericardial, ascitic, cerebrospinal fluid and semen.
28. The use and maintenance of the following centrifuge, colorimeter, chemical balance, haematocrit , various types of pipettes, urinometer, microhaematocrit centrifuge.
29. L.E. cell preparation. Study of parasites in the blood.
30. Study of parasistes in the blood.

TRANSFUSIONOLOGY :

1. Determination of blood group by both tube and slide methods.
2. Sources of errors in group determination—their elimination.
3. Titration of blood group antibodies in serum.
4. Coomb's test.
5. Major and minor cross matching (compatibility test),
6. Investigations of transfusion reactions.
7. Tests to detect diseases that can be transmitted through blood transfusion (VDRL test, tests for HbsAg, HIV using different methods).
8. Collection and storage of blood.

PATHOLOGY

Pattern of Examination in Pathology :

(A.) Theory examination 100 marks

There shall be one paper of 100 marks and three hours duration.

The paper shall consist of six questions

as follows :

- | | |
|---|----------|
| Q. 1. Full essay type question on
Histopathology and cytology | 15 marks |
| Q. 2. Full essay type question on
Haematology | 15 marks |
| Q. 3. Full essay type question on
Clinical Pathology | 15 marks |
| Q. 4. Full essay type question on
Transfusionology | 15 marks |
| Q. 5. Short notes on (any four) out of
five on Histopathology + Cytology
Transfusionology of 5 marks each | 20 marks |
| Q. 6. Short notes on (any four) out of
Five on Haematology and Clinical
Pathology of five marks each | 20 marks |

Practical and Viva-Voce Examination :

The examination would be conducted as follows with the following exercises :

- | | |
|--|----------|
| (a) Histotechniques | 10 marks |
| (b) Haematoxyline and eosin staining | 7 marks |
| (c) Special staining | 7 marks |
| (d) Estimation of Haemoglobin and determination of ESR
(Erythrocyte Sedimentation rate) | 10 marks |

(e) One test each from major and minor

Haematology exercises

15 marks

Major :-

(I) Preparation, staining and reporting of PBS.

(II) Total and differential leykocyte counts.

(III) Sickling test.

(IV) Prothrombin time determination.,

(V) Reticulocyte count.

Minor :

(I) Preparation of buffy coat smears.

(II) Bleeding and clotting time.

(III) Total R.B.C. count.

(IV) Preparation and staining of thick smear

(f) Determination of blood group

6 marks

(g) Urine examination — Routine physical and chemical

10 marks

(h) Spots

10 marks

(i) Viva

(20+5 marks for journal)

(10 + 7 + 7 + 10 + 15 + 6 + 10 + 10 + 25) = 100 Marks

LIST OF BOOKS RECOMMEDNED FOR D.M.L.T. COURSE

1. Clinical Chemistry in Diagnosis and Treatment. - Ziwa J.F.P Peter, Mayne P.D.
2. Practical Clinical Biochemistry – Verley Publications, W.H. Heinemann
3. A Biologist Guide to principle & Techniques of Practical Biochemistry :- William & Wilson, Edward Arnold
4. Lynch Medical Laboratory Technology – Rephale D.B,W.B Saunders.
5. Practical Biochemistry – Plummer
6. Text Book of Biochemistry – Ramkrishanan, Prasman & Rajan
7. Medical Biochemistry – A.C Deb
8. Medical Biochemistry - M.N. Chatterjee, Shinde
9. Medical Biochemistry - Das
10. Clinical Laboratory Methods – john D. Bener
11. Manual of Histopathological Techniques & their Diagnostic application – John D Bancroft, Hay C.Cook, Churchill Livingston
12. Clinical Diagnosis by Laboratory Examination John A Kokmer.

13. Text Book of Pathology Vol. I & II – N.C. Dey
14. Clinical Laboratory Diagnosis – Levinson S A, Mac Fate R.D.
15. Clinical Lab. Methods & Diagnosis Vol. I & II – Alex C,S L Garelt.
16. Clinical Lab. Methods – John D Bengner, Plilip G. Achermann, Gelsaon Toro
17. Handbook of Histopathological Technique – C.F.A. Culling.
18. Histopathological & Histological Technique – J.A. Kierman.
19. A New short Text Book of Microbial & Parasitic Infections – B.I. Duerden, T.M.S. Reid,
J.M. Jewsbury, D.C. Turk.
20. District Laboratory Practice in Tropical Countries Part – 1 & 2 – Monica Cheesbrough.
Cambridge Low- Price Edn.
21. Medical Laboratory Technology Vol. I, II & III – K.L. Mukherjee.
22. Medical Laboratory Technology – Pror. C.R. Maiti, New Central Book Agency Pvt Ltd.
Kolkata.
23. Medical Parasitology – Rajesh Karyakarte, A.S. Damle. Books & Allied Pvt. Ltd
Kolkata.
24. Text Book of Bacteriology – N C Day & T. K. Day
25. Parasitology – K.D. Chatterjee.
26. Text Book of Microbiology – Chakarbourty.

As per the Academic Council Resolution No. 393 / 2006 dtd. 29/08/2006, the suggestions made by Dr. A. N. Suryakar, Chairman, Pri-Clinical Board, Medical Faculty are incorporated in the DMLT Syllabus & Regulations prepared by the Committee under the Chairmanship of Dr. P. M. Bulakh on 14th July 2006.

(Dr. S. D. Dalvi)

Dean,

Medical Faculty, M.U.H.S., Nashik

(Dr. A. N. Suryakar)

Chairman,

Pri-Clinical Board, Medical Faculty