

# **FACULTY OF SCIENCES**

## **SYLLABUS FOR THE BATCH 2023-24**

**Programme Code: ZDMLS**

**Programme Name: Certificate/Diploma in Medical Laboratory Science  
(Semester I-II)**

**Examinations: 2023-2024**



## **Department of Zoology Khalsa College, Amritsar**

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(b) Subject to change in the syllabi at any time.  
(c) Please visit the College website time to time.

S. No.	PROGRAMME OBJECTIVES
1.	To demonstrate various safety rules in laboratory; cleaning and sterilization of glass ware.
2.	Understand laboratory apparatus and glassware; the preparation of chemical reagents and standards.
3.	Study various filtration methods, types of microscopes, blood test and preservation of different clinical samples.
4.	Study various blood and urine tests.
5.	Understand various pathogenic microbes and diseases caused by them, their occurrence and eradication programs.
6.	Understand the life history, mode of infection and pathogenicity and control measures of pathogenic protozoans and helminthes.

S.No.	PROGRAMME SPECIFIC OUTCOMES (PSOS)
PSO-1	Have knowledge of various safety rules in laboratory; cleaning and sterilization of glass ware.
PSO-2	Will be able to handle laboratory apparatus and glassware, chemical reagents, standards and equipment used in the pathology lab.
PSO-3	Analyse various blood, urine & other materials for any disease/abnormality.
PSO-4	Diagnose presence of various pathogens in a given sample.
PSO-5	The knowledge of Lifecycle of pathogens & vectors will enable them to participate in various eradication programs.

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**CERTIFICATE/DIPLOMA IN MEDICAL LABORATORY SCIENCE**

COURSE SCHEME											
SEMESTER - I											
Course Code	Course Name	Hours /Week	Credits			Total Credits	Max Marks				Page No.
			L	T	P		Th	P	IA	Total	
ZDMLS111	Good Laboratory Practices	4	3	1	-	4	75	--	25	100	4
ZDMLS112	Medical Laboratory Instrumentation	4	3	1	-	4	75	--	25	100	6
ZDMLS113	GLP Practical	4	-	-	4	2	--	37	13	50	8
ZDMLS114	MLI Practical	4	-	-	4	2	--	37	13	50	9
										300	

SEMESTER - II											
Course Code	Course Name	Hours /Week	Credits			Total Credits	Max Marks				Page No.
			L	T	P		Th	P	IA	Total	
ZDMLS121	Introduction to Pathogenic Diseases	4	3	1	-	4	75	--	25	100	10
ZDMLS122	Medical Diagnostic Techniques	4	3	1	-	4	75	--	25	100	12
ZDMLS123	IPD Practical	4	-	-	4	2	--	37	13	50	14
ZDMLS124	MDT Practical	4	-	-	4	2	--	37	13	50	15
										300	

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**CERTIFICATE/DIPLOMA IN MEDICAL LABORATORY SCIENCE**

**Semester-I**

**Theory**

**COURSE CODE: ZDMLT111**

**COURSE TITLE: GOOD LABORATORY PRACTICES**

**Credit Hours: 4 hrs.**

**Total Hours: 60 hrs.**

**Theory Paper: 37**

**Internal Assessment: 13**

**Total Marks: 50**

**Periods/week: 6**

**Time: 3 Hrs.**

**Instructions for the Paper Setters:**

1. There will be a total of 9 questions of which five are to be attempted.
2. Question 1 will be compulsory (9 marks). There will be of 8 short answer type questions (1.5 marks each) of which 6 are to be attempted.
3. The remaining 8 questions shall include two questions from each unit. Candidates shall be required to attempt 4 questions, one from each unit. Each question carries 7 marks. Preferably, the question should not be split into any sub-parts. In case of any splitting, it should not have more than two sub-parts.

**COURSE OBJECTIVES:** The paper aims to

1.	Demonstrate various safety rules in laboratory.
2.	Understand the maintenance of laboratory equipment
3.	Understand cleaning and sterilization of glass ware.
4.	Understand various laboratory hazards (fire, chemicals and biological)
5.	Understand personal safety and disposal of waste materials

**Unit- I**

- **Organization of Practical Work:**
  - Organization,
  - Cleaning up and Sterilization,
  - Disposal of Wastes
- **Maintenance of Equipment and Apparatus:**
  - Prevention of Dust,
  - Prevention of Corrosion and Rust,
  - Protection of Equipment from Excessive Heating
- **Security and Vandalism**

**Unit- II**

- **Electricity Hazards:** Dangers Associated with Electrical Equipment
- **Fire and Gas Hazards:**
  - Fire Hazards in the Laboratory- Causes and Classification of Fires
  - Precautions for Fire Prevention
  - Detection and Handling of Gas Leakage,
  - Health Hazards of Gases
- **Extinguishing a Fire:** Fire Extinguishers and its use

**Unit- III**

- **Chemical Hazards:**
  - Classification of Hazardous Chemicals
  - Handling and Storage of Chemicals
  - Transfer of bulk chemicals from Large Containers
- **Biological Hazards:**
  - Laboratory Animals- Supply, Handling and Disposal
  - Microorganisms- Handling, Sterilization of Apparatus and Disposal

**Unit- IV**

- **First Aid:**
  - General Features and Scope,
  - Placement and Contents of First Aid Box
- **First Aid Procedure:**
  - For Electric shock, Chemical accidents
  - Controlling bleeding
  - For Localized Injuries, Burns, Fractures, Eye Injuries
- **Personal Safety:**
  - Code of Behavior for the Laboratory Staff and Practice in a Laboratory
  - Personal Protective Devices
  - Disposal of Waste Materials

**Suggested Readings:**

1. Csuros, M., Environmental Sampling and Analysis, Lewis Publications.
2. Standard methods for the examination of water and wastewater, American Public Health Association, 19th ed., Washington D.C.

**Course Outcomes**

CO-1.	Students get to know about organization of practical work, maintenance of apparatus and equipment
CO-2.	Students get to know about laboratory safety rules like proper handling, specimens, needles etc.
CO-3.	Students get to know about laboratory hazards like chemical, fire etc.
CO-4	Students will be able to learn about personal safety and disposal of waste materials



**CERTIFICATE/DIPLOMA IN MEDICAL LABORATORY SCIENCE**

**Semester-I**

**Theory**

**COURSE CODE: ZDMLT112**

**COURSE TITLE: MEDICAL LABORATORY INSTRUMENTATION**

**Credit Hours: 4 hrs.**

**Total Hours: 60 hrs.**

**Theory Paper: 37**

**Internal Assessment: 13**

**Total Marks: 50**

**Periods/week: 6**

**Time: 3 Hrs.**

**Instructions for the Paper Setters:**

1. There will be a total of 9 questions of which five are to be attempted.
2. Question 1 will be compulsory (9 marks). There will be of 8 short answer type questions (1.5 mark each) of which 6 are to be attempted.
3. The remaining 8 questions shall include two questions from each unit. Candidates shall be required to attempt 4 questions, one from each unit. Each question carries 7 marks. Preferably, the question should not be split into any sub-parts. In case of any splitting, it should not have more than two sub-parts.

**COURSE OBJECTIVES:** The paper aims to

1.	Study various laboratory apparatus and glassware.
2.	Study the preparation of chemical reagents and standards.
3.	Study filtration methods.
4.	Study of Common software used in laboratory management

**UNIT-I**

- **Laboratory apparatus:**
  - Lab ware materials
  - Soft vs. Heat resistant glassware
  - Volumetric flask, pipette, burette
  - Cleaning of glassware and plastic ware
- **Analytical balances**
- **Desiccators.**

**UNIT-II**

- **Chemical reagents and stains:**
  - Grade and purity of chemicals
  - Proper storage of chemicals
  - Preparation of reagent grade water.
- **Fixatives and Stains:**
  - Common lab fixatives and stains
  - Single and double staining methods
  - Types of blood films and their preparation methods

**UNIT-III**

- **Filtration**
- **Centrifugation,**
- **Distillation and its types: Simple, Fractional, Vacuum.**
- **Drying and ashing of sample,**
- **Liquid extraction by separating funnel**

**UNIT-IV**

- **Software skills:**
  - Common softwares used in lab
  - Brief introduction to LIMS (Laboratory Information Management System)
  - Role of computers in Laboratory occupational health and safety
- **Future of Medical laboratory Instrumentation**

**Suggested Readings:**

1. Csuros, M., Environmental Sampling and Analysis, Lewis Publications.
2. Standard methods for the examination of water and wastewater, American Public Health Association, 19th ed., Washington D.C.

**COURSE OUTCOMES:**

CO-1.	The students will get to know about various laboratory glassware.
CO-2.	The students will get to know about chemical reagents and standards.
CO-3.	The students will get to know about different types of filtration methods.



**CERTIFICATE/DIPLOMA IN MEDICAL LABORATORY SCIENCE**

**Semester-I**

**COURSE CODE: ZDMLT113**

**COURSE TITLE: GLP PRACTICAL**

**Credit Hours: 4 hrs.**

**Total Hours: 60 hrs.**

**Practical Paper: 37**

**Internal Assessment: 13**

**Total Marks: 50**

**Periods/week: 6**

**Time: 3 Hrs.**

**Important Note for Practical:**

- A. Candidates will be required to submit their original note books containing record of their laboratory work.
- B. As per the latest UGC guidelines the dissections may please be avoided. In no case an animal falling under the categories of wildlife protection act 1972 should be caught or dissected. The rules of the Prevention of cruelty to Animals act 1960 should be familiar to all who are teaching the zoology courses. The guidelines on this issue are also available on the UGC website: [www.ugc.ac.in](http://www.ugc.ac.in)

**COURSE OBJECTIVES:** The paper aims to

1.	Demonstrate various safety rules in laboratory.
2.	Understand cleaning and sterilization of glass ware.

**Practical List**

1.	Demonstration of Safety rules in the laboratory.
2.	Proper handling of specimens.
3.	Disposal of syringes, needles etc.
4.	Demonstration of Personal protective devices used in laboratory.
5.	Demonstration of working of Fire extinguisher
6.	Various methods of Cleaning of Glass ware
7.	Sterilization of Glass ware using hot air oven, autoclave etc.
8.	Identification Classification of Chemical hazards
9.	Safe handling of hazardous chemicals using fume hood
10.	Identification of Fire hazards
11.	Safe handling of hazardous biological materials
12.	Safe handling of compressed gases

Note: - Some changes can be made in the practical depending on the availability of material

**COURSE OUTCOMES**

CO-1.	Students get to know about laboratory safety rules.
CO-2.	Understand proper handling of specimens etc.
CO-3.	Learn safe handling of hazardous materials



**CERTIFICATE/DIPLOMA IN MEDICAL LABORATORY SCIENCE**

**Semester-I**

**COURSE CODE: ZDMLT114**

**COURSE TITLE: MLI PRACTICAL**

**Credit Hours: 4 hrs.**

**Total Hours: 60 hrs.**

**Practical Paper: 37**

**Internal Assessment: 13**

**Total Marks: 50**

**Periods/week: 6**

**Time: 3 Hrs.**

**Important Note for Practical:**

- A. Candidates will be required to submit their original note books containing record of their laboratory work.
- B. As per the latest UGC guidelines the dissections may please be avoided. In no case an animal falling under the categories of wildlife protection act 1972 should be caught or dissected. The rules of the Prevention of cruelty to Animals act 1960 should be familiar to all who are teaching the zoology courses. The guidelines on this issue are also available on the UGC website: [www.ugc.ac.in](http://www.ugc.ac.in)

**COURSE OBJECTIVES:** The paper aims to

1.	Demonstrate various types of microscopes, centrifuges, balances, ovens etc.
2.	Understand preparation of solutions and standards.

**Practical List**

1.	Demonstration and working of	Different types of microscopes Analytical balances
2.	Preparation of	Reagent grade water
3	Staining	Making a stained blood smear
4	Preparation and standardization of	Common standard (percent, molar, Normal, iso-, hypo- and hper-tonic) solutions Standard and serial dilutions
5	Apparatus	Centrifuges Distillation sets Ovens Furnace
6	Glassware	Types of glass slides, coverslips, test tubes, pipettes etc.

Note: - Some changes can be made in the practical depending on the availability of material

**COURSE OUTCOMES:**

CO-1.	Students get to know about different types of microscopes, centrifuges, balances, ovens etc.
CO-2.	Students will get technical knowhow regarding the preparation of solutions and standards.



**CERTIFICATE/DIPLOMA IN MEDICAL LABORATORY SCIENCE**

**Semester-II**

**Theory**

**COURSE CODE: ZDMLT121**

**COURSE TITLE: INTRODUCTION TO PATHOGENIC DISEASES**

**Credit Hours: 4 hrs.**

**Total Hours: 60 hrs.**

**Theory Paper: 37**

**Internal Assessment: 13**

**Total Marks: 50**

**Periods/week: 6**

**Time: 3 Hrs.**

**Instructions for the Paper Setters:**

1. There will be a total of 9 questions of which five are to be attempted.
2. Question 1 will be compulsory (9 marks). There will be of 8 short answer type questions (1.5 marks each) of which 6 are to be attempted.
3. The remaining 8 questions shall include two questions from each unit. Candidates shall be required to attempt 4 questions, one from each unit. Each question carries 7 marks. Preferably, the question should not be split into any sub-parts. In case of any splitting, it should not have more than two sub-parts.

**COURSE OBJECTIVES:** The paper aims to

1.	Understand various pathogenic microbes and diseases caused by them, their occurrence and eradication programs.
2.	Understand the life history, mode of infection and pathogenicity of pathogenic protozoans and helminthes.
3.	Study the life cycle and control measures of arthropod vectors of human disease.

**UNIT-I**

- **Brief introduction of pathogenic microbes** (Viruses, Bacteria and Protozoan)
- **Viral diseases** (Mode of infection, pathogenicity, prophylaxis and treatment): Dengue, Yellow fever, Chikungunya

**UNIT-II**

- **Bacterial diseases** (Mode of infection, pathogenicity, prophylaxis and treatment): Typhoid, Cholera, Tuberculosis
- **Protozoan diseases** (Mode of infection, pathogenicity, prophylaxis and treatment): Malaria, Amoebic dysentery, Giardiasis

**UNIT-III**

- **Life history, mode of infection and pathogenicity, prophylaxis, treatment and control measures of following arthropod vectors:**
  - *Anopheles*
  - *Aedes*
  - *Culex*
  - *Xenopsylla*

**UNIT-IV**

- **Life history, mode of infection and pathogenicity, prophylaxis, treatment and control measures of following parasitic helminthes:**
  - *Taenia*
  - *Enterobius*
  - *Ascaris*

**Suggested Readings:**

1. Baker, F.J. and Silvertown, R.E. (1985) Introduction to Medical Laboratory Technology (6<sup>th</sup> ed), Butlerworth and Co. Ltd.
2. Chatterjee, K.D. (1995), Parasitology, Protozoology and Helminthology (12<sup>th</sup>ed).
3. Cheesborough, M. (1987), Medical Laboratory Technology for Tropical countries (2<sup>nd</sup>ed), Butlerworth and Co., Ltd.
4. Garcia, L.S. (2001), Diagnostic Medical Parasitology, (4<sup>th</sup>ed), ASM Press Washington.
5. Kimball, J.W. (1986), Introduction of Immunology, MacMillian Publishing Co., New York.
6. Kuby, J. (2000), Immunology, W.H. Freeman & Co., USA.
7. Roitt, I. (1984), Essential Immunology, Blackwell Scientific Publications, Oxford.
8. Talib, V.H. (1999), Essential Laboratory Manual, Mehta Publishers, New Delhi.

**COURSE OUTCOMES:**

CO-1.	Study of Pathogenic protozoans, helminthes, their pathogenicity, prophylaxis & treatment.
CO-2.	Learn about Pathogenic viruses and Bacteria.
CO-3.	Have insight into reproduction and control measures of vectors.
CO-4.	Know about the prevention and control measures of various diseases



**CERTIFICATE/DIPLOMA IN MEDICAL LABORATORY SCIENCE**

**Semester-II**

**Theory**

**COURSE CODE: ZDMLT122**

**COURSE TITLE: MEDICAL DIAGNOSTIC TECHNIQUES**

**Credit Hours: 4 hrs.**

**Total Hours: 60 hrs.**

**Theory Paper: 37**

**Internal Assessment: 13**

**Total Marks: 50**

**Periods/week: 6**

**Time: 3 Hrs.**

**Instructions for the Paper Setters:**

- 1) There will be a total of 9 questions of which five are to be attempted.
- 2) Question 1 will be compulsory (9 marks). There will be of 8 short answer type (1.5 mark each) of which 6 are to be attempted.
- 3) The remaining 8 questions shall include two questions from each unit. Candidates shall be required to attempt 4 questions, one from each unit. Each question carries 7 marks. Preferably, the question should not be split into any sub-parts. In case of any splitting, it should not have more than two sub-parts.

**COURSE OBJECTIVES:** The paper aims to-

1.	Understand of collection, preservation and various tests of different blood samples.
2.	Understand the importance of hemoglobin, its physiological variations and estimation.
3.	Understand various parameters related to bacteriology.
4.	Understand principle and significance of techniques related to histopathology and biochemistry.

**UNIT-I**

- **Collection and preservation of blood samples:** Collection of blood (venous and capillary), anticoagulants (Different types, merits and demerits), Romanowsky's stains
- **Haematology:** Composition of blood and its functions, Total RBC count, erythrocyte sedimentation rate, TLC, DLC, platelet count

**UNIT-II**

- **Hemoglobin:** Function, Normal and abnormal values and Physiological variations, Estimation by (a) Colorimetric Method, (b) Sahli's method, Clinical importance.
- **Histopathology:** Common fixatives and staining techniques

**UNIT-III**

- **Bacteriology:** sterilization (dry heat, moist heat, autoclave, filtration), disinfection, staining techniques, (gram stain, AFB stain, etc), culture media (defined and synthetic media & routine laboratory media), bacterial culture (aerobic and anaerobic) and antibiotic sensitivity

**UNIT-IV**

- **Biochemistry:** Significance of estimation of urea, sugar and cholesterol, creatinine, enzymes (serum transaminase, phosphatase, amylase and lipase), uric acid in blood;
- **Urine Tests:** Estimation of proteins, sugar, bile salts, ketone bodies.

**Suggested Readings:**

1. Baker, F.J. and Silverton, R.E. (1985) Introduction to Medical Laboratory Technology, (6<sup>th</sup> ed), Buterworth and Co. Ltd.
2. Chatterjee, K.D. (1995), Parasitology, Protozoology and Helminthology (12<sup>th</sup> ed).
3. Cheesborough, M. (1987), Medical Laboratory Technology for Tropical countries (2<sup>nd</sup> ed), Butlerworth and Co., Ltd.
4. Garcia, L.S. (2001), Diagnostic Medical Parasitology, (4<sup>th</sup>ed), ASM Press Washington.
5. Kimball, J.W. (1986), Introduction of Immunology, MacMillian Publishing Co., New York.
6. Kuby, J. (2000), Immunology, W.H. Freeman & Co., USA.
7. Roitt, I. (1984), Essential Immunology, Blackwell Scientific Publications, Oxford.
8. Talib, V.H. (1999), Essential Laboratory Manual, Mehta Publishers, New Delhi.

**COURSE OUTCOMES:**

CO-1.	Knowledge related to the techniques involved in detection of various diseases and its associated pathology.
CO-2.	Have practical skills of conducting basic clinical lab experiments.
CO-3.	Apply knowledge of clinical science and pathology to day to day life.
CO-4.	Understand impact of diseases and endo-parasites on human health
CO-5.	Learn about Physiology of Human Immune response.



**CERTIFICATE/DIPLOMA IN MEDICAL LABORATORY SCIENCE**

**Semester-II**

**COURSE CODE: ZDMLT123**

**COURSE TITLE: IPD PRACTICAL**

**Credit Hours: 4 hrs.**

**Total Hours: 60 hrs.**

**Practical Paper: 37**

**Internal Assessment: 13**

**Total Marks: 50**

**Periods/week: 6**

**Time: 3 Hrs.**

**Important Note for Practical:**

- A. Candidates will be required to submit their original note books containing record of their laboratory work.
- B. As per the latest UGC guidelines the dissections may please be avoided. In no case an animal falling under the categories of wildlife protection act 1972 should be caught or dissected. The rules of the Prevention of cruelty to Animals act 1960 should be familiar to all who are teaching the zoology courses. The guidelines on this issue are also available on the UGC website: [www.ugc.ac.in](http://www.ugc.ac.in)

**COURSE OBJECTIVES:** The paper aims to

1.	Study permanent slides of parasitic protozoans, helminthes and arthropods.
2.	Study the Preparation of blood smear showing different stages of plasmodium

**Practical List**

1.	Preparation of	blood smear showing different stages of plasmodium
2.	Study of permanent slides and specimens of Parasitic protozoans	<i>Entamoeba</i> <i>Giardia</i> <i>Plasmodium</i>
3	Study of permanent slides of	Mouth parts of <i>Anopheles</i> , <i>Culex</i>
4	Study of Permanent slides for identification of arthropods vectors	<i>Anopheles</i> <i>Aedes</i> <i>Culex</i> <i>Xenopsylla</i>
5	Study of Permanent slides for identification of helminths	<i>Taenia</i> <i>Enterobius</i> <i>Ascaris</i>
6	Study of common symptoms of	Human diseases and Parasitic infections
7	Vector control measures at	Household level Community level
8.	Control measures of various epidemic diseases	

Note: - Some changes can be made in the practical depending on the availability of material

**COURSE OUTCOMES:**

CO-1.	Students will be able to study the protozoans, parasitic helminthes, arthropods vectors of various diseases through permanent slides
CO-2.	Students will be able to examine stool for intestinal parasite



**CERTIFICATE/DIPLOMA IN MEDICAL LABORATORY SCIENCE**

**Semester-II**

**COURSE CODE: ZDMLT124**

**COURSE TITLE: MDT PRACTICAL**

**Credit Hours: 4 hrs.**

**Total Hours: 60 hrs.**

**Practical Paper: 37**

**Internal Assessment: 13**

**Total Marks: 50**

**Periods/week: 6**

**Time: 3 Hrs.**

**Important Note for Practical:**

- A. Candidates will be required to submit their original note books containing record of their laboratory work.
- B. As per the latest UGC guidelines the dissections may please be avoided. In no case an animal falling under the categories of wildlife protection act 1972 should be caught or dissected. The rules of the Prevention of cruelty to Animals act 1960 should be familiar to all who are teaching the zoology courses. The guidelines on this issue are also available on the UGC website: [www.ugc.ac.in](http://www.ugc.ac.in)

**COURSE OBJECTIVES:** The paper aims to

1.	Examine physicochemical properties of urine.
2.	Study various blood tests.

**Practical List**

1	Estimation of	ESR and hematocrit value Blood sugar and protein contents
2	Physico-chemical examination of urine	
3	Preparation of thick and thin blood smears	
4	Counting of WBC, RBC and DLC	
5	Analysis of blood groups (A, B, AB, O) and Rh factor	
6	Demonstration of various microtomy techniques	Fixation, embedding, cutting of tissue sections, and their staining method (Double staining Technique)

**Note: - Some changes can be made in the practical depending on the availability of material**

**COURSE OUTCOMES**

CO-1.	Students will get technical knowhow regarding estimation of Haemoglobin level, ESR, blood sugar, protein, cholesterol etc.
CO-2.	Students will be able to prepare thick and thin blood films and counting of WBC, RBC and DLC
CO-3.	Students will also perform physico-chemical examination of urine