



MERCER
COUNTY COMMUNITY COLLEGE

COURSE OUTLINE

Course Number	Course Title	Credits
MLT 112	Introduction to Medical Laboratory Technology	3
Hours: Lecture/Lab/Other 2/3	Co- or Pre-requisite permission of program coordinator	Semester & Year Summer 2023

Catalog description: Basic principles, techniques, and vocabulary applicable to medical laboratory technology. Topics include lab safety, specimen collection and transport, phlebotomy, urinalysis, immunology/serology, and computer technology as well as an overview of the four major laboratory disciplines of hematology/coagulation, immunohematology, chemistry, and microbiology. The laboratory component develops laboratory skills related to the lecture topics.

General Education Category:
Not GenEd

Course coordinator:
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Required texts & Other materials:

Required:

- i. Linne & Ringsrud's Clinical Laboratory Science Concepts, Procedures, and Clinical Applications Turgeon, Mary Louise (2023), 9th Edition, El Sevier ISBN-13: 978-0323829342
- ii. Instructor-developed Lab Manual (purchase through the bookstore)
- iii. MediaLab Subscription (provided by program budget) <https://www.medialab.com/>

Recommended, but not required

- The Phlebotomy Textbook
Strasinger & Di Lorenzo
(2019), 4th Edition, F.A. Davis Company ISBN-13: 978-0803668423
- Urinalysis & Body Fluids
Strasinger & Di Lorenzo
(2020), 7th Edition, F. A. Davis Company ISBN-13: 978-0803675827
- Contemporary Clinical Immunology & Serology
Rittenhouse-Olson, K. & DeNardin, E. (2021), 4th Edition, FA. Davis Co
ISBN-13: 978-0803694408

Needed Lab Materials:

- i. White lab coat- This must be a knee-length coat with a fitted wristband/cuff; it reduces the potential for splashes up the arm and fire hazards.
- ii. Gloves - latex or nitrile, not vinyl
- iii. Black or blue ink pen. (NO WORK IN PENCIL ACCEPTED)
- iv. Sharpie or other permanent marker, fine point, black or blue
- v. 3 ring binder w/Note pages:
 - √ Tabs or dividers are needed to identify and separate the following sections: Syllabus - including schedule and unit objectives, lecture PowerPoints, graded materials & other informative material.
 - √ Save all procedures, pre-labs, in-lab exercises, case studies and study questions.

Course Student Learning Outcomes (SLO):

Upon successful completion of this course, the student will be able to:

1. Identify the different clinical laboratory settings and roles in a health care organization. (Supports ILG# 3,4)
2. Identify the role of a medical laboratory professional in providing laboratory data utilized for the assessment of health and diseases. (Supports ILG# 1,3,4)
3. Develop an awareness of medical ethics and its application to the practice of health care. (Supports ILG 8,9)
4. Demonstrate knowledge of the major laboratory disciplines and basic laboratory techniques including specimen collection and preservation, laboratory safety, microscopy and the function of laboratory information systems.(Supports ILG# 3, 4, 10, 11)
5. Explain the value of using quality assurance programs in providing accurate and precise laboratory data. (Supports ILG# 2, 3, 4, 9, 10, 11)
6. Apply knowledge of phlebotomy and renal physiology to the collection and evaluation of body fluid samples. (Supports ILG# 1, 4, 8, 9, 10)
7. Correlate urinalysis and body fluid results with possible patient conditions. (Supports ILG# 1, 2, 3, 4,10,11)
8. Demonstrate knowledge of the Immune System and immunoassay principles and immunologic techniques used in the serology laboratory. (Supports ILG# 2, 3, 4, 10, 11)
9. Describe the basic function of each of the major disciplines of Clinical Laboratory Science: hematology/coagulation, immunohematology, chemistry and microbiology. (Supports ILG# 1,3, 4, 9, 10, 11)

Course-specific Institutional Learning Goals (ILG):

Institutional Learning Goal 1. Written and Oral Communication in English. Students will communicate effectively in both speech and writing.

Institutional Learning Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.

Institutional Learning Goal 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.

Institutional Learning Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

Institutional Learning Goal 5. Social Science. Students will use social science theories and concepts to analyze human behavior and social and political institutions and to act as responsible citizens.

Institutional Learning Goal 8. Diversity and Global Perspective: Students will understand the importance of a global perspective and culturally diverse peoples

Institutional Learning Goal 9. Ethical Reasoning and Action. Students will understand ethical frameworks, issues, and situations.

Institutional Learning Goal 10. Information Literacy: Students will recognize when information is needed and have the knowledge and skills to locate, evaluate, and effectively use information for college level work.

Institutional Learning Goal 11. Critical Thinking: Students will use critical thinking skills understand, analyze, or apply information or solve problems.

Program Learning Outcomes (PLO) for Medical Laboratory Technology

1. Integrate knowledge learned and experienced in the disciplines of general education, mathematics, science, and medical laboratory science;
2. Achieve entry-level career competencies of a medical laboratory technician by testing biological samples using current technology to generate accurate, quality-assured laboratory results used for health and disease evaluation;
3. Utilize critical-thinking skills to assess and problem- solve laboratory data for patient diagnoses;
4. Maintain familiarity with the profession's code of ethics and consistently act within those standards during interactions with fellow classmates and working professionals in the clinical setting;
5. Describe the importance of continuing education in lifelong learning and in obtaining and upholding professional credentialing;
6. Demonstrate academic and technical competence in the professional courses of the curriculum through college and applied clinical education experiences;
7. Take the national ASCP certification exam.

Units of study in detail – Unit Student Learning Outcomes:

Unit 1: Introduction into the Medical Laboratory Profession and Specimen Collection and Handling

[Supports Course SLOs #1, 2, 3, 6]

Learning Objectives

The student should be able to:

1. Describe an overview of the practice of a medical laboratory professional.
2. List professional societies associated with clinical laboratory science, stating each society's continuing education policy.
3. Review the professional code of ethics for Medical Laboratory Professionals.
4. Describe the importance of behavior consistent with the ASCLS Code of Ethics.
5. List five steps in one value-based decision-making model.
6. Define the terms: accreditation, certification, and licensure.
7. Identify CLIA regulations involving clinical lab certification as waived, physician-performed microscopy, moderate or high complexity testing laboratories.
8. Demonstrate knowledge and application of the Principles of the Right to Know Act and the Bloodborne Pathogens Act.
9. Demonstrate the proper use of safety equipment used in the lab and relate its use in following guidelines set by OSHA for standard precautions.
10. Recognize the signs and symbols used to signify potential contact with radiation, carcinogens, poisons, biohazards, and flammable substances.
11. Discuss medical ethics, define law, consent, confidentiality, and liability.
12. Discuss the skills needed to properly perform venipuncture and capillary blood collection techniques.
13. Identify the equipment found on a phlebotomy tray.
14. Identify common anticoagulants & additives used to preserve blood specimens.
15. Demonstrate knowledge of the color coding system for evacuated tubes.
16. Recognize the importance of accurate patient identification, discuss HIPAA and respect patient confidentiality.
17. State the difference between informed consent and implied consent.
18. Centrifuge a blood sample – understand the terms: hemolysis, lipemia, bilirubinemia.
19. Define the term: Point of Care Testing and state examples of test procedures performed at the patient's bedside.
20. Discuss a patient's bill of rights.

Psychomotor Performance Objectives:

1. Attend an Information Literacy session developed and presented by the MCCC Library staff.
2. Demonstrate the ability to locate reliable primary information resources using a web browser.
3. Access the MCCC Library webpage developed for the MLT program.
4. Access internet websites for the professional societies of clinical laboratory science.
5. Clean bench tops with 10% bleach solution before and after performing clinical laboratory testing.
6. Properly perform proper hand washing, gowning, gloving, masking and double bagging technique.
7. Observe and discuss techniques for collecting samples from newborns.
8. Practice performing venipuncture and capillary procedures applying standard practices and guidelines.
9. Review videos on Infection Prevention and Blood Collection Techniques using MediaLab, Inc.

Unit 2: Understanding the Quality Practices and Equipment/Technology used in Clinical Laboratory Settings

[Supports Course SLOs #4, 5]

Learning Objectives

The student learner should be able to:

1. Compare and contrast the function and operation of a hospital laboratory and a research laboratory.
2. Identify the metric units of measurement (weight, length, volume, temp.).
3. Explain the purpose of using a quality assurance program in the laboratory.
4. Compare controls and standards understanding the function of each.
5. List the overall function of a Laboratory Information System as it relates to pre-analytic, analytic and post-analytic function in a laboratory.

6. Explain the correlation of a LIS interfacing with laboratory instruments and to the Hospital Information System or outreach centers.
7. Discuss the purposes that DNA sequencing information is routinely used for in the clinical laboratory
8. State the "central dogma" relating to nucleic acid function.
9. List the 4 nitrogen bases for DNA and state which ones pair together.
10. State the composition of a: nucleoside, nucleotide, pyrimidine and purine.
11. State the 5 carbon sugar of DNA.
12. State the direction of DNA synthesis.
13. Complete a sequence of nitrogen bases create the complementary strand.

Psychomotor Performance Objectives:

1. In group settings, establish appropriate professional interpersonal skills and cultural sensitivity as it relates to special situations during the practice of phlebotomy.
2. Master venipuncture and capillary procedures using a variety of collection materials (straight needle and winged butterfly sets)
3. In timed laboratory practicals, students will perform phlebotomy techniques exhibiting good communication skills.
4. Identify the various parts of the compound microscope and describe the function of each part.
5. Demonstrate the proper care and maintenance of a microscope.
6. Demonstrate the techniques of using flasks, graduated cylinders, pipettes, and centrifuges in the preparation of solutions, aliquots, and dilutions prepared in the clinical laboratory.
7. Calculate and perform dilution procedures.

Unit 3: The Urinary System [Supports Course SLOs #7]

Learning Objectives

The student learner should be able to:

1. Identify the anatomy of the kidney and the physiology of the renal system.
2. Explain renal physiology including the principles of filtration, re-absorption and secretion.
3. Describe the physical characteristics of urine and correlate abnormal physical characteristics to common clinical conditions or disease.
4. Describe the chemical properties of urine that are tested in each area of reagent strip testing.
5. Apply the principle of each test strip area and correlate abnormal results with common clinical conditions or disease.
6. Recognize, identify, and evaluate organized and unorganized sediment from stained and unstained preps in a urine microscopic exam.
7. Correlate physical, chemical, & microscopic findings & recognize discrepancies.
8. Identify common kidney diseases and correlate the disease with expected laboratory data results.
9. Analyze case studies in urinalysis correlating laboratory data to normal and abnormal clinical diagnosis.
10. State the principle of reflectance.

Psychomotor Performance Objectives:

1. Following standard practices perform the physical, chemical, & microscopic analyses of urinalysis samples.
2. Operate a clinical instrument for urinalysis including quality control assessment and recognizing a need for basic maintenance and troubleshooting.
3. Identify urinary sediment constituents on kodachrome slide and/or diagrams.
4. Perform quality control procedures in urinalysis using control material.
5. Review the Clinitek manual for basic troubleshooting of the instrument.
6. In timed laboratory practicals, students will perform urinalysis testing and evaluation.

Unit 4: The Immune System [Supports Course SLOs #8]

Learning Objectives

The student learner should be able to:

1. Discuss and compare the body's innate and adaptive immune systems.

2. Identify characteristics and properties of immunoglobulin classes.
3. Compare the description and function of cells associated with the immune response.
4. State the characteristics and properties of antigens.
5. State the characteristics and properties of antibodies.
6. Explain the role of the MHC in the immune response.
7. Compare the primary and secondary response of immune system.
8. Describe the four classifications of hypersensitivity.
9. List the components of complement.
10. Differentiate between the classical and alternate pathways of complement activation.
11. Explain the biological functions of complement.
12. Differentiate between active and passive immunity, correlate the types of immunity received from vaccines, toxoids, attenuated bacteria, antitoxins and gamma globulin.

Psychomotor Performance Objectives:

1. Observe demonstration of ANA procedure and identify positive cells on the fluorescent microscope.
2. Distinguish between homogeneous and speckled patterns.
3. Demonstrate competency using flocculation and agglutination assay kits to assess patients for the presence of specific diseases such as Rheumatoid Arthritis, Infectious mononucleosis and Syphilis.

Unit 5: Department-specific Clinical Laboratory Testing Supports Course SLOs #9]

Learning Objectives

The student should be able to:

Hematology

1. Differentiate between serum and plasma and state the approximate percentage of each in a healthy person's blood.
2. Discuss hematopoiesis and differentiate between the formed elements of blood.
3. Discuss the preferred specimens for hematology tests.
4. Name the tests that are part of the complete blood count and describe the use of each.

Basic Immunohematology (Blood Banking)

1. Explain the purpose of the blood bank department.
2. Describe the procedure used to obtain donor blood units.
3. State the four possible components of blood units.
4. Name the four blood groups in the ABO system and the frequency of each in the United States.
5. Name the blood group antigens and antibodies present in each of the four groups.
6. Define "Universal Donor" and "Universal Recipient".
7. Explain forward and reverse grouping.
8. Explain the importance of the Rh blood group system.

Basic Clinical Microbiology

1. List the fields of study included in microbiology.
2. Describe the organization of the microbiology department in small and large laboratories.
3. Discuss the differences in normal flora, pathogens, and opportunistic pathogens.
4. Explain how infection occurs.
5. Discuss the three basic shapes of bacteria.

Clinical Chemistry

1. List six body fluids that are tested in clinical chemistry.
2. Discuss the proper collection and handling of blood specimens for chemical analysis.
3. Discuss six blood collection problems that may interfere with test results.
4. Explain how the blood level of some chemical substances varies according to the time of day.
5. List 15 constituents commonly assayed in a chemistry profile.
6. Explain the significance or function of each of the constituents commonly included in a chemistry profile.

Psychomotor Performance Objectives:

1. Given a sample of red blood cells correctly perform the ABO typing procedure.
2. Given the results of an ABO typing correctly interpret the results.
3. Prepare at least three slide smears which are even, smooth and have an acceptable feathered edge.

4. Correctly utilize the four quadrant streak method to plate microorganisms.
5. Understand the importance of POCT assays and discuss the principle of some of different types of waived POCT assays: glucometer, fecal occult blood test, etc.

Evaluation of student learning:

1. Lecture

- a) Students will have weekly homework assignments through Blackboard LMS or via MediaLab Inc and must be completed to assess understanding of the theoretical concepts discussed in the lecture powerpoints.
- b) Students will complete a weekly quiz, midterm and final assessment through Blackboard LMS or via MediaLab Inc.
- c) There is a writing assignment where the student will utilize MCCC Library services to demonstrate research skills and assess students understanding of ethics.

2. Lab

- a) Students will complete weekly quizzes (pre-lab and/or post-lab) and complete weekly homework assignments that pertain to the laboratory exercises.
- b) There will be written and hands-on practical assessments at the halfway point and at the end of the course to assess competency level.
- c) Laboratory Session Professional Performance- Students' professional performances will be evaluated during each of the laboratory sessions and weekly feedback will be given on how to improve. The grading scale for each of the categories below is that a student can score between 0-2 points (0= Unsatisfactory, 1=Satisfactory, 2=Exceeds Expectations).
- d) PROFESSIONAL PERFORMANCE EVALUATION:

1. DEPENDABILITY

- The student arrives in the laboratory with adequate time to start lab session as scheduled. The student comes with appropriate manual and supplies, and wearing required laboratory attire. The student shows evidence of having reviewed the assigned topic before coming to the laboratory. The student completes assignments (lab reports, homework assignments, etc) on time.

2. ATTENTIVENESS

- The student is attentive to the instructor, takes complete notes and proceeds with laboratory work without repeated instructions. The student follows verbal and written instructions, asks pertinent questions when necessary, and seeks the instructor's assistance when needed. The student neither distracts others nor allows distractions to affect completion of laboratory exercises.

3. ORGANIZATION

- The student demonstrates the ability to organize work to be done within the available laboratory time. The student is able to perform multiple tasks without jeopardizing accuracy and precision.

4. INDEPENDENCE

- The student demonstrates the ability to work independently by exercising independent judgement and thinking logically in using the protocols and instructions given. The student draws on previously gained information to solve problems without prompting from instructor. The student seeks activities to expand knowledge, ability and performance.

5. RECORD KEEPING

- The student demonstrates the importance of proper record keeping by accurately and legibly labeling/recording laboratory work and reports (i.e. sample containers, reagents and worksheets).

6. MANAGEMENT AND ECONOMY

- The student conserves reagents and supplies. The student maintains an adequate supply of common use items at their appropriate workstation. The student takes proper care of equipment

7. SAFETY

- The student works in an orderly and safe manner, enabling others to safely work in the same general area. The student adheres to the guidelines of the Laboratory Safety Regulations (e.g. wearing eye protection, keeping long hair tied back, and properly storing hazardous materials).

8. INTERPERSONAL SKILLS

- The student communicates in a professional, positive, tactful manner with peers and instructors. The student consistently shows common courtesy (e.e. restocks supplies) and contributes towards achieving an environment conducive to work and learning for self and others.

9. Composure

- The student maintains composure and work quality under stressful conditions and adapts quickly to new situations. The student recognizes his/her own personal strengths and weaknesses and works positively within that framework. The student accepts evaluation of performance as constructive when offered by instructors and follows through with suggestions made.

10. INTEGRITY

- The student accepts accountability for work performed. The student readily admits errors, follows procedures (including quality control) as written, and maintains confidentiality of patient results, if applicable. Student exhibits perseverance to obtain accurate results

Course Grading

A	93-100%	B-	80-82
A-	90-92	C+	77-79 <- minimum grade needed for total course grade
B+	87-89	C	70-76 <- minimum grade needed in Laboratory
B	83-86	D	60-69
F	0-59%		

Lecture

Writing Project	5%
Assignments	20%
-Homework	
-Discussion Board	
*Quizzes	20%
Midterm	25%
Final	<u>30%</u>
100% x .65 = _____ Lecture Percentage	

Laboratory

Laboratory Exercises/Assessments	20%
Competencies (Phleb, UA, Immunology)	30%
Midterm Assessment/Practical	20%
Final Exam (Comprehensive)	<u>30%</u>
100% x .30 = _____ Lab Percentage	

Professionalism (Affective)

Attendance	_____ / 600 points possible (100% for presence, 50% if tardy, & 0% if absent for each week)
Professionalism*	_____ / 120 points
_____ / 720 = x .05 = _____ Affective Percentage	

_____ Final Total Grade = Lecture Percentage + Lab Percentage + Professionalism