MLT-2991: ADVANCED MLT APPLICATIONS

Cuyahoga Community College

Viewing: MLT-2991 : Advanced MLT Applications

Board of Trustees:
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Academic Term:
Fall 2025

Subject Code
MLT - Medical Laboratory Technology

Course Number:
2991

Title:
Advanced MLT Applications

Catalog Description:
Manual laboratory skills in clinical chemistry, hematology, coagulation, body fluids, microbiology, parasitology, mycology, and immunohematology/serology are refined—emphasis on organization, increased speed, accuracy, confidence, and independent performance. Case studies are analyzed, data interpreted, and findings are correlated to clinical significance and differential diagnoses. Advanced concepts in parasitology, mycology, immunohematology/serology, quality control, point of care, information systems and troubleshooting are introduced.

Credit Hour(s):
3

Lecture Hour(s):
2

Lab Hour(s):
3

Requisites

Prerequisite and Corequisite
MLT-1001 Introduction to Medical Laboratory Science, MLT-1352 Problem Solving Techniques for the Medical Laboratory, MLT-1491 Urinalysis and Body Fluids, MLT-2461 Hematology, MLT-2472 Immunohematology, MLT-2490 Immunology and Serology, MLT-2501 Clinical Chemistry, and concurrent enrollment in MLT-2482 Clinical Microbiology.

Outcomes

Course Outcome(s):
A. Demonstrate safe and accountable behaviors within the laboratory setting.

Objective(s):
1. Apply knowledge of personal protective equipment (PPE) and Standard Precautions to ensure personal safety and prevent contamination.
2. Operate laboratory equipment safely and correctly to minimize risk and achieve accurate results.
3. Adhere to laboratory safety protocols and procedures to maintain a secure working environment for oneself and others.

Course Outcome(s):
B. Demonstrate ethical and professional behaviors within the laboratory setting.

Objective(s):
1. Document laboratory findings accurately, and with appropriate identifying information.
2. Apply proper procedures for correcting laboratory documentation, ensuring transparency and traceability.
3. Practice clear and concise communication in lecture and laboratory settings.

4. Actively listen to and respectfully address questions, concerns, and feedback from others in the laboratory.
5. Foster a collaborative and inclusive environment by valuing diverse perspectives and contributions.
6. Reflect on personal performance and identify areas for improvement.

Course Outcome(s):

C. Integrate knowledge of hematology laboratory disciplines to correlate multidepartment laboratory findings with various anemias, leukemias, and hemostasis disorders.

Objective(s):

1. Classify different types of anemias based on their morphologic, pathophysiologic, and laboratory characteristics.
2. Evaluate iron studies, vitamin B12/folate levels, and other relevant laboratory tests to aid in the diagnosis and management of anemias.
3. Distinguish between acute and chronic leukemias based on their clinical features, cell morphology, and immunophenotypic markers.
4. Correlate laboratory findings with clinical manifestations and discuss the prognostic implications of specific leukemia subtypes.
5. Differentiate between bleeding and thrombotic disorders based on clinical presentation and laboratory findings.
6. Interpret coagulation profiles, platelet function tests, and other relevant laboratory assays to identify and diagnose various hemostasis disorders.
7. Correlate laboratory results with the pathophysiology of specific hemostasis disorders and their clinical manifestations.

Course Outcome(s):

D. Integrate knowledge of clinical chemistry laboratory disciplines to correlate multidepartment laboratory findings with various relevant pathologies.

Objective(s):

1. Classify different types of endocrine disorders based on their pathophysiology, clinical presentations, and laboratory findings.
2. Interpret hormone levels, including thyroid function tests, adrenal function tests, and reproductive hormone assays, to aid in the diagnosis and management of endocrine disorders.
3. Correlate laboratory results with clinical manifestations of endocrine disorders.
4. Differentiate between various types of hepatitis based on clinical presentation, serological markers, and liver function tests.
5. Interpret liver enzymes, bilirubin, albumin, and coagulation studies testing to assess liver health and disease progression.
7. Distinguish between acute kidney injury and chronic kidney disease based on clinical features, laboratory findings, and imaging studies.
8. Interpret renal function tests, including creatinine, blood urea nitrogen, glomerular filtration rate, and electrolytes, to assess kidney function and disease progression.
9. Correlate laboratory results with the stages of CKD and discuss the implications for patient management.
10. Explain the principles and applications of TDM in optimizing drug therapy and minimizing toxicity.
11. Identify drugs commonly monitored using TDM and discuss their therapeutic ranges, pharmacokinetics, and potential drug interactions.
12. Evaluate the impact of various factors on drug pharmacokinetics and TDM interpretation.
13. Identify the key cardiac markers used in the diagnosis and monitoring of heart disease and myocardial injuries.
14. Correlate laboratory findings with clinical presentation and discuss the appropriate management strategies for patients with suspected or confirmed myocardial injury.

Course Outcome(s):

E. Integrate knowledge of urinalysis and body fluid analysis to correlate multidepartment laboratory findings with various diseases and conditions, including those affecting the renal system, central nervous system, and serous cavities.

Objective(s):

1. Correlate abnormal urinalysis results with various renal and systemic disorders, including glomerulonephritis, nephrotic syndrome, urinary tract infections, and diabetes mellitus.
2. Discuss the clinical significance of urinary casts, crystals, and cells in the diagnosis of renal and systemic disorders.
3. Interpret CSF analysis results, including cell counts, protein, glucose, and microbiology, to differentiate between various central nervous system (CNS) disorders.
4. Correlate CSF findings with clinical presentations of meningitis, encephalitis, multiple sclerosis, and other CNS infections and inflammatory conditions.
5. Discuss the importance of proper CSF collection and handling to ensure accurate laboratory results and interpretation.
6. Differentiate between transudates and exudates based on fluid characteristics and laboratory findings.

7. Interpret fluid analysis results, including cell counts, protein, glucose, and microbiology, to aid in the diagnosis of various conditions affecting serous cavities.
8. Correlate fluid findings with clinical presentations of infections, malignancies, and other inflammatory conditions affecting the pleural, peritoneal, and synovial spaces.

Course Outcome(s):

F. Integrate knowledge of immunology and serology laboratory testing to correlate multidepartment laboratory findings with autoimmune and immunodeficiency disorders.

Objective(s):

1. Classify different types of autoimmune disorders based on their pathophysiology, clinical presentations, and laboratory findings.
2. Interpret antinuclear antibody tests, specific autoantibody assays, and other relevant laboratory tests to aid in the diagnosis and monitoring of autoimmune diseases.
3. Correlate laboratory results with clinical manifestations and discuss appropriate follow-up testing strategies for specific autoimmune disorders.
4. Evaluate the use of immunologic assays in assessing disease activity, predicting prognosis, and monitoring response to therapy in autoimmune diseases.
5. Interpret lymphocyte subsets, immunoglobulin levels, complement assays, and other relevant laboratory tests to identify and diagnose various immunodeficiency disorders.
6. Correlate laboratory results with the pathophysiology of specific immunodeficiency disorders and their clinical manifestations.
7. Evaluate the use of specialized immunologic tests in diagnosing and monitoring immunodeficiency disorders.

Course Outcome(s):

G. Integrate knowledge of immunohematology principles and laboratory techniques to correlate laboratory findings with various anemias and fetomaternal diseases.

Objective(s):

1. Describe the role of immunohematology in the diagnosis and management of immune-mediated hemolytic anemias.
2. Interpret direct antiglobulin test results, antibody identification panels, and other relevant laboratory tests to identify the underlying cause of hemolysis.
3. Correlate laboratory findings with clinical manifestations and discuss appropriate follow-up testing and treatment strategies for immune-mediated hemolytic anemias.
4. Evaluate the use of specialized immunohematology tests in diagnosing complex cases of hemolytic anemia.
5. Interpret prenatal antibody screening and identification results to assess the risk of HDFN.
6. Correlate maternal antibody titers, fetal antigen typing, and other relevant laboratory tests to predict the severity of HDFN and guide management decisions.
7. Evaluate the role of amniocentesis, cordocentesis, and other specialized procedures in monitoring and managing HDFN.
8. Discuss the importance of Rh immune globulin administration in preventing Rh alloimmunization and HDFN.

Course Outcome(s):

H. Apply quality control (QC) and quality assurance (QA) principles and practices to ensure accurate, reliable, and timely laboratory testing.

Objective(s):

1. Perform all necessary quality controls when performing laboratory testing.
2. Document all quality control, function verification, maintenance, troubleshooting.
3. Recognize proper samples for testing and causes for rejection.
4. Identify sources of interferences in testing.
5. Organize workflow allowing for multitasking, optimize time.
6. Effectively communicate with peers and staff, written and verbally.
7. Write an SOP for a POCT test.

Course Outcome(s):

I. Perform phlebotomy procedures.

Objective(s):

1. Assess subjects for suitable venipuncture/capillary sites.
2. Perform blood collection in accordance with Clinical and Laboratory Standards Institute (CLSI) standards of care.
3. State the proper order of draw and type of tube for given tests.
4. State the stipulations of the Health Insurance Portability and Accountability Act (HIPAA), including what constitutes protected health information (PHI).

Course Outcome(s):

J. Perform selected laboratory tests as needed to assist in the simulated patient cases.

Objective(s):

1. Perform tests using manual and automatic.
2. Employ quality control protocol.
3. Review results comparing data for accuracy.
4. Perform troubleshooting when necessary and follow up on issues.
5. Compare and contrast POCT methods to alternative methods, including sensitivity and specificity.
6. Discuss how results are reported and stored.

Course Outcome(s):

K. Describe the Laboratory Information System (LIS).

Objective(s):

1. Describe the daily and cyclic monitoring and maintenance.
2. Describe the security systems in place for the LIS.
3. Describe the back-up systems and contingency plans for system down time.
4. Describe the possible LIS output content and forms of output.
5. Describe interfaces to other systems.
6. Describe the functions of middleware and its applications.
7. Describe reflexive testing, stating examples.
8. Use the Electronic Health Record (EHR)
9. Train on the proper use of the EHR.
10. Procure/create and input various case studies into the EHR.
11. Utilize the EHR for mock lab data.

Course Outcome(s):

L. Describe professional behaviors.

Objective(s):

1. State the importance of promptly arriving at the lab/returning to the lab after breaks.
2. State the importance of documentation in all function verification, preventive, maintenance, trouble logs, shift logs, etc.
3. Describe the significance of performing proficiency testing and indicate when to perform.

Course Outcome(s):

M. Develop and deliver a presentation that analyzes a healthcare issue directly relevant to the medical laboratory.

Essential Learning Outcome Mapping:

Oral Communication: Demonstrate effective verbal and nonverbal communication for an intended audience that is clear, organized, and delivered effectively following the standard conventions of that language.
Information Literacy: Demonstrate contextual awareness of the research process through the reflective discovery of the production and value of information, the use of information in the creation of new knowledge and ethical participation in the use of information in communities of learning.

Objective(s):

1. Research and identify a relevant healthcare issue that highlights the critical role of the medical laboratory.
2. Analyze a relevant healthcare issue, determining its causes, consequences, and implications for patient care, public health, and the healthcare system.
3. Using evidence-based information, offer potential solutions or interventions to address the identified healthcare issue.
4. Create a presentation to communicate findings and recommendations effectively.
5. Deliver a presentation confidently and professionally, using effective communication skills and displaying an understanding of the subject matter.

Methods of Evaluation:

1. Written assignments
2. Group activities
3. Projects
4. Discussions
5. Case studies
6. Skills assessments
7. Lab exercises
8. Quizzes
9. Exams
10. Lab Practicals

Course Content Outline:

1. Safety
    a. Personal Protective Equipment (PPE)
    b. Standard Precautions
    c. Safe Equipment Operation
    d. Laboratory Safety Protocols
2. Ethical and Professional Conduct
    a. Documentation
        i. Accurate
        ii. Confidential
        iii. Proper corrections
    b. Effective Communication
        i. Active Listening
        ii. Respectful Interaction
    c. Fostering collaboration
    d. Inclusive environment
    e. Self-Reflection
    f. Self-Improvement
3. Hematology
    a. Anemia
        i. Classification
        ii. Tests
            1. Iron Studies
            2. Vitamin B12/Folate Levels
            3. Other Anemia-Related Tests
        iii. Diagnoses
    b. Leukemia
        i. Acute
            1. Features
            2. Prognosis
        ii. Chronic
            1. Features
            2. Prognosis
        iii. Laboratory Findings
        iv. Clinical Correlations
    c. Hemostasis

        i. Bleeding and Thrombotic Disorders
            1. Clinical Manifestations
            2. Pathophysiology
            3. Identification
            4. Diagnosis
            5. Coagulation Profiles
            6. Platelet Function Tests
            7. Other Hemostasis Assays
4. Clinical Chemistry
    a. Endocrine
        i. Classification
        ii. Diagnosis
        iii. Hormone Assays
        iv. Clinical Correlations
    b. Hepatitis
        i. Types
        ii. Serological Markers
        iii. Liver Function Tests
            1. Liver Enzymes
            2. Bilirubin
            3. Albumin
            4. Coagulation Studies
        iv. Liver Fibrosis
        v. Cirrhosis Stages
    c. Renal
        i. Acute Kidney Injury
        ii. Chronic Kidney Disease
            1. Stages
            2. Management
        iii. Renal Function Tests
        iv. Disease Progression
    d. Therapeutic Drug Monitoring (TDM)
        i. Drugs Monitored by TDM
        ii. Pharmacokinetics
    e. Cardiac Markers
        i. Heart Disease
        ii. Myocardial Injury
            1. Laboratory findings
            2. Management strategies
5. Urinalysis and Body Fluid Analysis
    a. Renal disease
    b. CNS
    c. Serous cavity disorders
    d. Urinalysis
        i. Abnormal results
        ii. Disease correlations
            1. Urinary Casts
            2. Crystals
            3. Cells
    e. CSF Analysis
        i. Techniques
        ii. Interpretation
        iii. CSF Findings
        iv. Clinical Correlations
        v. Proper CSF Collection and Handling
    f. Transudates vs. Exudates
6. Immunology and Serology

a. Autoimmune and Immunodeficiency Disorders
    i. Classification
    ii. Testing
        1. Antinuclear Antibody Tests
        2. Autoantibody Assays
        3. Other Immunological Tests
    iii. Diagnosis
    iv. Laboratory Findings
    v. Clinical Correlations
    vi. Disease Assessment
    vii. Disease Monitoring
    viii. Pathophysiology
    ix. Clinical Manifestations
b. Specialized Immunologic Tests

7. Immunohematology
    a. Immune-Mediated Hemolytic Anemias
        i. Mechanisms
        ii. Testing
            1. Direct Antiglobulin Test
            2. Antibody Identification
            3. Other tests
        iii. Laboratory findings
        iv. Clinical Correlations
        v. Diagnosis
        vi. Management
    b. (Hemolytic Disease of the Fetus and Newborn) HDFN
        i. Prenatal antibody screening
            1. Identification of HDFN Risk
            2. Maternal Antibody Titers
            3. Fetal Antigen Typing
            4. HDFN Severity Prediction
            5. Monitoring
            6. Managing HDFN
        ii. Rh Immune Globulin
        iii. Prevention of Rh Alloimmunization
    c. Specialized Immunohematology Tests
8. Quality Management and Laboratory Operations
    a. Quality Control (QC)
        i. Procedures
        ii. Interfering substances
        iii. Rejection criteria
        iv. Documentation
        v. Maintenance
        vi. Troubleshooting
        vii. Westgard Multirules
    b. Quality Assurance (QA)
        i. Workflow Organization
        ii. Time Management
        iii. Effective Communication in the Laboratory
        iv. Writing Standard Operating Procedures (SOPs) for Point-of-Care Testing (POCT)
    c. Phlebotomy Procedures
        i. Venipuncture
        ii. Capillary
        iii. Blood Collection Techniques
        iv. Order of Draw
        v. Tube Selection
    d. HIPAA and PHI
9. Laboratory Testing

   a. Manual testing
   b. POCT
   c. Automated testing
   d. Result review
   e. Troubleshooting
   f. Results
      i. Reporting
      ii. Storing
10. Laboratory Information Systems (LIS)
   a. Monitoring
   b. Maintenance
   c. Security
   d. Backup Systems
   e. Output
   f. Interfaces
   g. Middleware
   h. Reflexive Testing
   i. Electronic Health Records (EHR)
11. Professional Development
   a. Professional Behaviors
   b. Punctuality
   c. Time Management
   d. Documentation Practices
   e. Proficiency Testing
   f. Continuing education
   g. Community service

Resources

ASCP Board of Certification. *Board of Certification Study Guide - Clinical Laboratory Certification Examinations*. 6th. Chicago, IL: ASCP Press, 2018.

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Strasinger, Susan King and Di Lorenzo, Marjorie Schaub. *Urinalysis and Body Fluids*. 7th. Philadelphia, PA: F. A. Davis Company, 2021.

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Harmening, Denise. *Modern Blood Banking and Transfusion Practices*. 7th. Philadelphia, PA: F.A. Davis, 2019.

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Mahon, Connie and Lehman, Donald . *Textbook of Diagnostic Microbiology*. 6th. St. Louis, MO: Elsevier, 2019.

Sunheimer, Robert and Graves, Linda. *Clinical Laboratory Chemistry (Pearson Clinical Laboratory Science Series)*. 2nd. NY, NY: Pearson, 2018.

Turgeon, Mary Louise. *Linné & Ringsrud's Clinical Laboratory Science : Concepts, Procedures, and Clinical Applications*. 8th. St. Louis, MO: Elsevier, 2019.

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