

## 2005 Mississippi Curriculum Framework

### Postsecondary Medical Laboratory Technology

(Program CIP: 51.1004 – Clinical/Medical Laboratory Technician)

#### Direct inquiries to

John Adcock  
Director for Career and Technical Education  
State Board for Community and Junior Colleges  
3825 Ridgewood Road  
Jackson, MS 39211  
(601) 432-6518

#### Additional copies

Research and Curriculum Unit for Workforce Development  
Vocational and Technical Education  
Attention: Reference Room and Media Center Coordinator  
P.O. Drawer DX  
Mississippi State, MS 39762  
[www.rcu.msstate.edu/curriculum/downloads](http://www.rcu.msstate.edu/curriculum/downloads)  
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## Acknowledgments

**Writing Team:** Evelyn Wallace, Pearl River Community College, Forrest County  
 Gretchen Cunningham, Mississippi Gulf Coast Community College, Jackson County  
 Jackie Brocato, Mississippi Delta Community College, Moorhead  
 Knox Poole, Meridian Community College, Meridian  
 Mary Shivers, Copiah-Lincoln Community College, Wesson  
 Rilla Jones, Northeast Community College, Booneville  
 Timothy Henry, Hinds Community College, Nursing/Allied Health Center

**RCU Staff:** Stephanie King, Ph.D. – Research, Curriculum, and Assessment Specialist

**Professional Curriculum Advisory Team:** Meridian Community College Medical Laboratory Technology Advisory Committee  
 Mississippi Delta Community College Medical Laboratory Technology Advisory Committee

Standards in this document are based on information from the following organizations:

**Standards of Accredited Educational Programs for the Clinical Laboratory Technician/Medical Laboratory Technician by the National Accrediting Agency for Clinical Laboratory Sciences**

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**Workplace Skills for the 21<sup>st</sup> Century**

Secretary's Commission on Achieving Necessary Skills

**ISTE National Educational Technology Standards for Students**

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## Foreword

As the world economy continues to evolve, businesses and industries must adopt new practices and processes in order to survive. Quality and cost control, work teams and participatory management, and an infusion of technology are transforming the way people work and do business. Employees are now expected to read, write, and communicate effectively; think creatively, solve problems, and make decisions; and interact with each other and the technologies in the workplace. Vocational-technical programs must also adopt these practices in order to provide graduates who can enter and advance in the changing work world.

The curriculum framework in this document reflects these changes in the workplace and a number of other factors that impact on local vocational-technical programs. Federal and state legislation calls for articulation between high school and community college programs, integration of academic and vocational skills, and the development of sequential courses of study that provide students with the optimum educational path for achieving successful employment. National skills standards, developed by industry groups and sponsored by the U.S. Department of Education and Labor, provide vocational educators with the expectations of employers across the United States. All of these factors are reflected in the framework found in this document.

Each postsecondary program of instruction consists of a program description and a suggested sequence of courses which focus on the development of occupational competencies. Each vocational-technical course in this sequence has been written using a common format which includes the following components:

- Course Name – A common name that will be used by all community/junior colleges in reporting students.
- Course Abbreviation – A common abbreviation that will be used by all community/junior colleges in reporting students.
- Classification – Courses may be classified as:
  - Vocational-technical core – A required vocational-technical course for all students.
  - Area of concentration (AOC) core – A course required in an area of concentration of a cluster of programs.
  - Vocational-technical elective – An elective vocational-technical course.
  - Related academic course – An academic course which provides academic skills and knowledge directly related to the program area.
  - Academic core – An academic course which is required as part of the requirements for an Associate degree.
- Description – A short narrative which includes the major purpose(s) of the course and the recommended number of hours of lecture and laboratory activities to be conducted each week during a regular semester.

- Prerequisites – A listing of any courses that must be taken prior to or on enrollment in the course.
- Corequisites – A listing of courses that may be taken while enrolled in the course.
- Competencies and Suggested Objectives – A listing of the competencies (major concepts and performances) and of the suggested student objectives that will enable students to demonstrate mastery of these competencies.

The following guidelines were used in developing the program(s) in this document and should be considered in compiling and revising course syllabi and daily lesson plans at the local level:

- The content of the courses in this document reflects approximately 75 percent of the time allocated to each course. The remaining 25 percent of each course should be developed at the local district level and may reflect:
  - Additional competencies and objectives within the course related to topics not found in the State framework, including activities related to specific needs of industries in the community college district.
  - Activities which develop a higher level of mastery on the existing competencies and suggested objectives.
  - Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed/revised.
  - Activities which implement components of the Mississippi Tech Prep initiative, including integration of academic and vocational-technical skills and coursework, school-to-work transition activities, and articulation of secondary and postsecondary vocational-technical programs.
  - Individualized learning activities, including worksite learning activities, to better prepare individuals in the courses for their chosen occupational area.
- Sequencing of the course within a program is left to the discretion of the local district. Naturally, foundation courses related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other courses related to specific skill areas and related academics, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors.
- Programs that offer an Associate of Applied Science degree must include a minimum 15 semester credit hour academic core. Specific courses to be taken within this core are to be determined by the local district. Minimum academic core courses are as follows:
 

○ 3 semester credit hours	Math/Science Elective
○ 3 semester credit hours	Written Communications Elective
○ 3 semester credit hours	Oral Communications Elective
○ 3 semester credit hours	Humanities/Fine Arts Elective
○ 3 semester credit hours	Social/Behavioral Science Elective

It is recommended that courses in the academic core be spaced out over the entire length of the program, so that students complete some academic and vocational-technical courses each semester. Each community/junior college has the discretion to select the actual courses that are required to meet this academic core requirement.

- In instances where secondary programs are directly related to community and junior college programs, competencies and suggested objectives from the high school programs are listed as Baseline Competencies. These competencies and objectives reflect skills and knowledge that are directly related to the community and junior college vocational-technical program. In adopting the curriculum framework, each community and junior college is asked to give assurances that:
  - Students who can demonstrate mastery of the Baseline Competencies do not receive duplicate instruction, and
  - Students who cannot demonstrate mastery of this content will be given the opportunity to do so.
- The roles of the Baseline Competencies are to:
  - Assist community/junior college personnel in developing articulation agreements with high schools, and
  - Ensure that all community and junior college courses provide a higher level of instruction than their secondary counterparts.
- The Baseline Competencies may be taught as special “Introduction” courses for 3-6 semester hours of institutional credit which will not count toward Associate degree requirements. Community and junior colleges may choose to integrate the Baseline Competencies into ongoing courses in lieu of offering the “Introduction” courses or may offer the competencies through special projects or individualized instruction methods.
- Technical elective courses have been included to allow community colleges and students to customize programs to meet the needs of industries and employers in their area.

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## Program Description

The Medical Laboratory Technology curriculum is a two-year Associate of Applied Science degree program of study that prepares individuals to work in a medical laboratory. As members of the health care delivery team, clinical laboratory personnel are responsible for assuring reliable and accurate laboratory test results that contribute to the diagnosis, treatment, prognosis, and prevention of physiological and pathological conditions. This program is designed to meet the standards and requirements for careers in clinical laboratory science. At career entry, the medical laboratory technician/clinical laboratory technician will be able to perform routine clinical laboratory tests (such as hematology, clinical chemistry, immunohematology, microbiology, serology/immunology, coagulation, molecular, and or emerging diagnostics) as the primary analyst making specimen-oriented decisions on predetermined criteria. Upon successful completion of the technical program, the student will be eligible to take a national certification examination. This program is accredited by the National Accrediting Agency for Clinical Laboratory Science (NAACLS), 8410 West Bryn Mawr Avenue, Suite 670, Chicago, IL, 60631, (773) 714-8880.

## Suggested Course Sequence\* Medical Laboratory Technology

Baseline Competencies for Medical Laboratory Technology\*\*

### FIRST YEAR

3 sch	Written Communications Elective	3 sch	Math/Science Elective
1 sch	Fundamentals of Medical Laboratory Technology/ Phlebotomy (MLT 1111)	3 sch	Immunology/Serology (MLT 1413)
2 sch	Urinalysis/Body Fluids (MLT 1212)	4 sch	Hematology II (MLT 1324)
3 sch	Hematology I (MLT 1313)	4 sch	Approved Electives†
8 sch	Approved Electives†	5 sch	Clinical Chemistry (MLT 1515)
<hr style="width: 100%;"/>		19 sch	
17 sch			

### SECOND YEAR

3 sch	Humanities/Fine Arts Elective	3 sch	Social/Behavioral Science Elective
4 sch	Immunochemistry (MLT 2424)	3 sch	Oral Communications Elective
4 sch	Approved Elective†	6 sch	Clinical Practice I (MLT 2916)
2 sch	Parasitology (MLT 2512)	6 sch	Clinical Practice II (MLT 2926)
4 sch	Pathogenic Microbiology (MLT 2614)	0-3 sch	Vocational-Technical Elective†† (District option)
0-3 sch	Vocational-Technical Elective†† (District option)	<hr style="width: 100%;"/>	
17-20 sch		18-21 sch	

### SUMMER TERM

6 sch	Clinical Practice III (MLT 2936)
0-6 sch	Vocational-Technical Elective†† (District Option)
<hr style="width: 100%;"/>	
6-12 sch	

\* Students who lack entry level skills in math, English, science, etc., will be provided related studies.

\*\* Baseline competencies are taken from the high school Allied Health program. Students who can document mastery of these competencies should not receive duplicate instruction. Students who cannot demonstrate mastery will be required to do so.

† APPROVED ELECTIVES - MEDICAL LABORATORY TECHNOLOGY

General Biology I (BIO 1133)  
Anatomy and Physiology I (BIO 1513)  
Anatomy and Physiology II (BIO 1523)  
Microbiology (BIO 2924)  
General Chemistry Laboratory I (CHE 1211)  
General Chemistry I (CHE 1213)  
General Chemistry Laboratory II (CHE 1221)  
General Chemistry II (CHE 1223)  
Principles of Chemistry I (CHE 1314)  
Principles of Chemistry II (CHE 1324)

†† APPROVED VOCATIONAL-TECHNICAL ELECTIVES

Principles of Organic and Biochemistry (MLT 1523)  
Medical Laboratory Technology Seminar (MLT 2711)  
Certification Fundamentals for Medical Laboratory Technology (MLT 2723)  
Clinical Instrumentation (MLT 2812)  
(Vocational-Technical Electives may be offered during any semester of the Sophomore year.)

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## Medical Laboratory Technology Courses

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**Course Name:** Fundamentals of Medical Laboratory Technology/Phlebotomy

**Course Abbreviation:** MLT 1111

**Classification:** Vocational–Technical Core

**Description:** The course includes an overview of the field of Medical Laboratory Technology, as well as familiarization with laboratory safety, microscopes, glassware, and equipment. It also includes laboratory organization, medical ethics, and employment opportunities. Basic laboratory specimen collection techniques are introduced. (1 sch: 2 hr. lab)

**Prerequisite:** None

<b>Competencies and Suggested Objectives</b>
<p>1. Explain the relationship between medical ethics and professionalism to the field of clinical laboratory science.</p> <ul style="list-style-type: none"> <li>a. Discuss the history of the clinical laboratory, and state the major organizational structure of the hospital laboratory.</li> <li>b. Discuss the importance and impact of medical ethics on patient care, especially confidentiality of test results as required by current federal and state regulations.</li> <li>c. Differentiate among the roles of various health care professionals.</li> <li>d. Explain the responsibilities of each classification of laboratory staff.</li> <li>e. State the regulatory and professional agencies related to laboratories and discuss their functions.</li> <li>f. Discuss federal regulations that impact laboratory operations and management.</li> <li>g. Discuss employment opportunities available to the graduates of Medical Laboratory Technology Programs.</li> </ul>
<p>2. Recommend and implement currently approved laboratory safety procedures.</p> <ul style="list-style-type: none"> <li>a. Discuss the common laboratory hazards to include:               <ul style="list-style-type: none"> <li>(1) chemical</li> <li>(2) fire</li> <li>(3) biological</li> <li>(4) mechanical</li> <li>(5) electrical</li> </ul> </li> <li>b. Describe and demonstrate the proper method for handling and disposing of biological hazards.</li> <li>c. Describe and/or demonstrate the use of basic laboratory safety equipment.</li> <li>d. Describe basic first aid procedures.</li> <li>e. Explain the appropriate local safety procedures.</li> <li>f. Demonstrate compliance with standard precautions.</li> <li>g. Discuss and select the appropriate isolation technique for various clinical conditions.</li> <li>h. Demonstrate knowledge of MSDS by reading and interpreting Material Safety Data Sheets.</li> </ul>

- |   |
|---|
| <p>3. Select and use basic equipment to perform selected laboratory skills.</p> <ol style="list-style-type: none"> <li>List the basic tests performed in each of the major departments of the laboratory and explain their purpose.</li> <li>Perform introductory laboratory skills to include:           <ol style="list-style-type: none"> <li>pipetting</li> <li>use and care of glassware</li> <li>use and care of microscopes</li> <li>use and care of other lab equipment</li> </ol> </li> </ol>  |
| <p>4. Explain and practice laboratory specimen collection techniques.</p> <ol style="list-style-type: none"> <li>Perform basic laboratory specimen collection techniques, including phlebotomy.</li> <li>Demonstrate protocols used in identification of specimens and the procedures used to maintain accurate patient identity.</li> <li>Discuss complications encountered in specimen collection.</li> <li>Select an appropriate method of resolving problems of specimen collection.</li> <li>Employ measures to maintain patient confidentiality.</li> </ol> |

## STANDARDS

### *Standards of Accredited Educational Programs for the Clinical Laboratory Technician/Medical Laboratory Technician*

- MLT2 The student will be trained in collecting, processing, and analyzing biological specimens and other substances.
- MLT4 The student will be trained in communications sufficient to serve the needs of patients and the public.
- MLT7 The student will be trained in laboratory safety and regulatory compliance.
- MLT9 The student will be trained in ethical and professional conduct.
- MLT10 The student will be trained in significance of continued professional development.

### *Related Academic Standards*

- C1 Interpret written material.
- C2 Interpret visual materials (maps, charts, graphs, tables, etc.).
- C4 Access, organize, and evaluate information.
- C5 Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.
- C6 Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.
- S1 Explain the Anatomy and Physiology of the human body.
- S6 Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.
- S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

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*Workplace Skills for the 21st Century*

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- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

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*National Educational Technology Standards for Students*

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- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools

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*Suggested References*

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*Medicomp modules* [Computer software]. (n.d.). Lincoln, VT: Shiesl.

Phelan, S. (1990). *Blood collection: The pediatric patient* [Videotape]. Chicago: American Society of Clinical Pathologists.

Sommer, S. R., & Warekois, R. S. (2002). *Phlebotomy worktext and procedures manual*. Philadelphia: W. B. Saunders.

Strasinger, S. K., & Di Lorenzo, M. S. (2001). *Urinalysis and body fluids*. Philadelphia: F. A. Davis.

**Course Name:** Urinalysis/Body Fluids

**Course Abbreviation:** MLT 1212

**Classification:** Vocational–Technical Core

**Description:** This course is an introduction to urinalysis and laboratory analysis of miscellaneous body fluids. It includes the basic principles of routine and special urine tests, and specimen examination through laboratory work. Theory and test profiles are also presented for miscellaneous body fluids with correlation to diseased states. (2 sch: 1 hr. lecture, 2 hr. lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1.	Describe the formation and composition of urine. <ol style="list-style-type: none"> <li>a. Discuss the history and importance of urinalysis.</li> <li>b. Describe the functioning unit of the kidney.</li> <li>c. Trace the formation of urine.</li> <li>d. Discuss the special urinalysis screening test.</li> </ol>
2.	Explain the properties involved in the physical, chemical, and microscopic examinations of urine. <ol style="list-style-type: none"> <li>a. List and describe the physical characteristics of urine.</li> <li>b. List and describe the chemical characteristics of urine.</li> <li>c. Identify the microscopic elements of urine.</li> <li>d. Describe specimen collection and handling of urine to include:               <ol style="list-style-type: none"> <li>(1) special instructions to patient</li> <li>(2) labeling of specimen</li> <li>(3) specimen containers</li> <li>(4) specimen preservation</li> </ol> </li> </ol>
3.	Perform the testing involved in the physical, chemical, and microscopic examinations of urine. <ol style="list-style-type: none"> <li>a. Perform the physical examination of urine including color, clarity, and specific gravity.</li> <li>b. List and describe the principles of the reactions of the reagent strip testing of urinalysis.</li> <li>c. Interpret chemical reactions of reagent strips.</li> <li>d. Identify microscopic elements in the urine.</li> <li>e. Correlate disease states with abnormal physical, chemical, and microscopic results.</li> </ol>
4.	Describe the laboratory testing and the formation of other body fluids (i.e., synovial, CSF, seminal, serous body fluids, amniotic fluids, etc.). <ol style="list-style-type: none"> <li>a. List and describe physical, chemical, and microscopic tests performed on the following body fluids: synovial, CSF, seminal body fluids, serous body fluids, and amniotic fluids.</li> <li>b. Correlate abnormal test results with disease states.</li> </ol>

**STANDARDS**

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*Standards of Accredited Educational Programs for the Clinical Laboratory Technician/Medical Laboratory Technician*

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- MLT1 The student will be trained in methodologies for all major areas currently practiced by a modern clinical laboratory, including problem solving and troubleshooting techniques.
- MLT2 The student will be trained in collecting, processing, and analyzing biological specimens and other substances.
- MLT3 The student will be trained in laboratory result use in diagnosis and treatment.
- MLT4 The student will be trained in communications sufficient to serve the needs of patients and the public.
- MLT6 The student will be trained in quality assessment in the laboratory.
- MLT7 The student will be trained in laboratory safety and regulatory compliance.
- MLT8 The student will be trained in information processing in the clinical laboratory.
- MLT9 The student will be trained in ethical and professional conduct.

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*Related Academic Standards*

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- C1 Interpret written material.
- C2 Interpret visual materials (maps, charts, graphs, tables, etc.).
- C3 Listen, comprehend, and take appropriate actions.
- C4 Access, organize, and evaluate information.
- M4 Explore the concepts of measurement.
- S1 Explain the Anatomy and Physiology of the human body.
- S5 Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.
- S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

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*Workplace Skills for the 21st Century*

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- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

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*National Educational Technology Standards for Students*

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- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

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- Strasinger, S. K., & Di Lorenzo, M. S. (2001). *Urinalysis and body fluids*. Philadelphia: F. A. Davis.

**Course Name:** Hematology I

**Course Abbreviation:** MLT 1313

**Classification:** Vocational–Technical Core

**Description:** This course is a study of the function of blood, morphology, and maturation of normal cells, blood cell counts, differentials of white cells, and blood collection and handling. (3 sch: 2 hr. lecture, 2 hr. lab)

**Prerequisite:** None

<b>Competencies and Suggested Objectives</b>	
1.	Discuss and identify the origin and characteristics of normal blood cell lines. <ol style="list-style-type: none"> <li>a. Identify sites of hematopoiesis.</li> <li>b. Outline the development of the blood cell lines to include:               <ol style="list-style-type: none"> <li>(1) erythrocytes</li> <li>(2) granulocytes</li> <li>(3) lymphocytes</li> <li>(4) monocytes</li> <li>(5) megakaryocytes/platelets</li> </ol> </li> <li>c. Differentiate morphologic and functional characteristics of developmental stages of each cell line.</li> </ol>
2.	Perform routine manual and automated hematology procedures. <ol style="list-style-type: none"> <li>a. State the principle of routine manual and automated hematology procedures.</li> <li>b. Prepare, stain, and evaluate manual peripheral blood smears.</li> <li>c. Perform manual and automated cell counts.</li> <li>d. Perform manual and automated hemoglobin and hematocrit determinations.</li> <li>e. Calculate red blood cell (RBC) indices.</li> <li>f. Correlate RBC indices with RBC morphology.</li> <li>g. Identify and recognize factors that may alter test values.</li> <li>h. State normal reference ranges for hematologic test procedures.</li> </ol>
3.	Explain the role of hematology safety. <ol style="list-style-type: none"> <li>a. Identify appropriate hematology safety techniques.</li> <li>b. Demonstrate appropriate hematology safety techniques.</li> </ol>
4.	Explain and perform quality assurance procedures and interpret quality control data. <ol style="list-style-type: none"> <li>a. Select the quality control techniques used for routine hematology procedures.</li> <li>b. Perform quality control procedures.</li> <li>c. Record and interpret quality control data.</li> <li>d. Analyze quality control data to determine validity of hematology lab test results.</li> </ol>
5.	Correlate clinical conditions with hematology test results. <ol style="list-style-type: none"> <li>a. Correlate and verify automated cell counts and differentials with established criteria and/or peripheral smear exam.</li> <li>b. Assess physiologic and pathologic causes for variations in hematologic data.</li> </ol>

**STANDARDS***Standards of Accredited Educational Programs for the Clinical Laboratory Technician/Medical Laboratory Technician*

- MLT1 The student will be trained in methodologies for all major areas currently practiced by a modern clinical laboratory, including problem solving and troubleshooting techniques.
- MLT2 The student will be trained in collecting, processing, and analyzing biological specimens and other substances.
- MLT3 The student will be trained in laboratory result use in diagnosis and treatment.
- MLT4 The student will be trained in communications sufficient to serve the needs of patients and the public.
- MLT6 The student will be trained in quality assessment in the laboratory.
- MLT7 The student will be trained in laboratory safety and regulatory compliance.
- MLT8 The student will be trained in information processing in the clinical laboratory.
- MLT9 The student will be trained in ethical and professional conduct.

*Related Academic Standards*

- C1 Interpret written material.
- C2 Interpret visual materials (maps, charts, graphs, tables, etc.).
- C3 Listen, comprehend, and take appropriate actions.
- C4 Access, organize, and evaluate information.
- C5 Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.
- C6 Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.
- M1 Relate number relationships, number systems, and number theory.
- M2 Explore patterns and functions.
- M3 Explore algebraic concepts and processes.
- M4 Explore the concepts of measurement.
- M6 Explore concepts of statistics and probability in real world situations.
- M7 Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.
- S1 Explain the Anatomy and Physiology of the human body.
- S7 Explore the principles of genetic and molecular Biology to include the relationship between traits and patterns of inheritance, population genetics, the structure and function of DNA, and current applications of DNA technology.
- S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

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*Workplace Skills for the 21st Century*

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- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

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*National Educational Technology Standards for Students*

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- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

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*Suggested References*

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- Anderson, S. C., & Poulsen, K. B. (2003). *Atlas of hematology*. Baltimore: Lippincott Williams & Wilkins.
- Asiton, M. L., Behrens, J. A., Ching, A., Curtis, J. D., Murray, C., Pagliaro, L., et al. (1995). *Peripheral blood tutor* [CD-ROM]. Seattle, WA: University of Washington.
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- Spahn, M. A., & Fannon, M. (n.d.). *Erythrocyte inclusions* [Computer software]. Dayton, OH: Educational Materials for Health Professionals.
- Turgeon, M. L. (1999). *Clinical hematology* (3<sup>rd</sup> ed.). Philadelphia: Lippincott Williams & Wilkins.

**Course Name:** Hematology II

**Course Abbreviation:** MLT 1324

**Classification:** Vocational–Technical Core

**Description:** This course includes the study of abnormal cell morphology and diseases involving blood cells, test procedures used in laboratory diagnosis of hematological disease, normal and abnormal hemostasis, and diagnostic procedures for evaluation of bleeding abnormalities and anticoagulant therapy. (4 sch: 2 hr. lecture, 4 hr. lab)

**Prerequisite:** Hematology I (MLT 1313)

<b>Competencies and Suggested Objectives</b>	
1.	Discuss and identify the origin and characteristics of abnormal blood cells. <ol style="list-style-type: none"> <li>Identify and describe physiology of each type of leukocyte.</li> <li>Describe red blood cell (RBC) production to include hemoglobin synthesis and catabolism and RBC biochemistry.</li> <li>Identify abnormal RBC and white blood cell (WBC) morphology, inclusions, and cytochemical stains.</li> <li>Evaluate platelets.</li> </ol>
2.	Correlate clinical conditions with abnormal hematology laboratory results. <ol style="list-style-type: none"> <li>Calculate and correlate RBC indices with microscopic morphology and disease states.</li> <li>Assess lab data to identify major types of anemia.</li> <li>Recognize leukemic cells and assess lab data in major types of leukemia.</li> <li>Identify the clinical manifestations and cause(s) for hemostatic, thrombotic, and fibrinolytic disease states.</li> <li>Research new concepts and emerging technologies to include bone marrow/stem cell transplant and molecular techniques in diagnosis and treatment of hematologic diseases.</li> </ol>
3.	Describe the interaction of blood vessels, platelets, coagulation factors, and fibrinolytic systems in normal and abnormal hemostasis and thrombosis. <ol style="list-style-type: none"> <li>Describe the production and characteristics of coagulation factors.</li> <li>Evaluate coagulation test data for clinical significance in diagnosis and treatment of hemostatic and thrombotic disorders.</li> <li>Explain the action and laboratory monitoring of anticoagulants in therapy of thrombotic disease.</li> </ol>
4.	Perform and interpret manual and automated hematology and coagulation procedures. <ol style="list-style-type: none"> <li>Discuss the principle of manual and automated hematology coagulation procedures.</li> <li>Operate and interpret results from hematology and coagulant instruments.</li> <li>Assess results to evaluate validity and identify sources of error.</li> <li>Propose solutions to correct erroneous results.</li> <li>Interpret quality control data to assess validity of patient results.</li> </ol>

**STANDARDS***Standards of Accredited Educational Programs for the Clinical Laboratory Technician/Medical Laboratory Technician*

- MLT1 The student will be trained in methodologies for all major areas currently practiced by a modern clinical laboratory, including problem solving and troubleshooting techniques.
- MLT2 The student will be trained in collecting, processing, and analyzing biological specimens and other substances.
- MLT3 The student will be trained in laboratory result use in diagnosis and treatment.
- MLT4 The student will be trained in communications sufficient to serve the needs of patients and the public.
- MLT6 The student will be trained in quality assessment in the laboratory.
- MLT7 The student will be trained in laboratory safety and regulatory compliance.
- MLT8 The student will be trained in information processing in the clinical laboratory.
- MLT9 The student will be trained in ethical and professional conduct.

*Related Academic Standards*

- C1 Interpret written material.
- C2 Interpret visual materials (maps, charts, graphs, tables, etc.).
- C3 Listen, comprehend, and take appropriate actions.
- C4 Access, organize, and evaluate information.
- C5 Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.
- C6 Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.
- M1 Relate number relationships, number systems, and number theory.
- M2 Explore patterns and functions.
- M3 Explore algebraic concepts and processes.
- M4 Explore the concepts of measurement.
- M6 Explore concepts of statistics and probability in real world situations.
- M7 Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.
- S1 Explain the Anatomy and Physiology of the human body.
- S6 Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.
- S7 Explore the principles of genetic and molecular Biology to include the relationship between traits and patterns of inheritance, population genetics, the structure and function of DNA, and current applications of DNA technology.
- S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

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*Workplace Skills for the 21st Century*

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- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

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*National Educational Technology Standards for Students*

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- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

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*Suggested References*

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- Anderson, S. C., & Poulsen, K. B. (2003). *Atlas of hematology*. Baltimore: Lippincott Williams & Wilkins.
- Asiton, M. L., Behrens, J. A., Ching, A., Curtis, J. D., Murray, C., Pagliaro, L., et al. (1995). *Peripheral blood tutor* [CD-ROM]. Seattle, WA: University of Washington.
- Blood collection: Troubleshooting and helpful hints* [Videotape]. (n.d.). Franklin Lakes, NJ: Becton Dickinson.
- Carr, J. H., & Rodak, B. F. (2004). *Clinical hematology atlas*. Philadelphia: W. B. Saunders.
- Estridge, B. H., Reynolds, A. P., & Walters, N. J. (2000). *Basic medical laboratory techniques* (4<sup>th</sup> ed.). Albany, NY: Delmar.
- Harmening, D. M. (2002). *Clinical hematology and fundamentals of hemostasis*. Philadelphia: F. A. Davis.
- Hematology* [Electronic image collection software]. (2002). Philadelphia: W.B. Saunders.

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- Phelan, S. (1990). *Blood collection: The pediatric patient* [Videotape]. Chicago: American Society of Clinical Pathologists.
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- Spahn, M. A., & Fannon, M. (n.d.). *Erythrocyte inclusions* [Computer software]. Dayton, OH: Educational Materials for Health Professionals.
- Turgeon, M. L. (1999). *Clinical hematology* (3<sup>rd</sup> ed.). Philadelphia: Lippincott Williams & Wilkins.

**Course Name:** Immunology/Serology

**Course Abbreviation:** MLT 1413

**Classification:** Vocational–Technical Core

**Description:** This course covers the science of immunology and serology through the study of theories and processes related to natural body defenses. Included are basic antigen-antibody reactions, complement action, cellular response, humoral immune response, and the basic serological procedures used to aid in the detection of certain diseases. Throughout this course, special emphasis is placed on correlating laboratory results with the patient's probable condition. (3 sch: 2 hr. lecture, 2 hr. lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1. Describe the body's immune defenses.	<ul style="list-style-type: none"> <li>a. Explain the principal mechanisms of acquired and natural immunity.</li> <li>b. Describe the function of the cells of the immune system.</li> <li>c. Explain the components of natural immunity and their functions.</li> <li>d. List the characteristics of antigens.</li> <li>e. Describe the primary immune response.</li> <li>f. Describe the secondary immune response.</li> <li>g. Differentiate among the five immunoglobulin classes and their functions.</li> <li>h. Outline the sequential steps of the classical and alternate complement pathways.</li> <li>i. Describe biologic functions associated with complement activation.</li> </ul>
2. Describe the principles of immunoassays.	<ul style="list-style-type: none"> <li>a. Explain the principles of the commonly used immunoassays.</li> <li>b. Evaluate physiological and pathological causes for variation in expected test results.</li> <li>c. Examine test results to identify and correct technical sources of error.</li> </ul>
3. Perform routine immunology/serology procedures with emphasis on accuracy and precision.	<ul style="list-style-type: none"> <li>a. Perform the commonly used immunoassay procedures.</li> <li>b. Summarize specimen requirements for commonly used immunoassay procedures.</li> <li>c. Demonstrate the use of proper quality control methods for each testing procedure.</li> <li>d. Interpret the validity of patient test results.</li> <li>e. Prepare accurate, simple, and serial dilutions.</li> <li>f. Calculate specimen concentrations involved in simple and serial dilutions.</li> </ul>
4. Correlate results of immunological procedures with clinical conditions.	<ul style="list-style-type: none"> <li>a. State the expected serologic test results for commonly encountered clinical conditions.</li> <li>b. Assess causes of false positive and false negative test results.</li> </ul>

**STANDARDS***Standards of Accredited Educational Programs for the Clinical Laboratory Technician/Medical Laboratory Technician*

- MLT1 The student will be trained in methodologies for all major areas currently practiced by a modern clinical laboratory, including problem solving and troubleshooting techniques.
- MLT2 The student will be trained in collecting, processing, and analyzing biological specimens and other substances.
- MLT3 The student will be trained in laboratory result use in diagnosis and treatment.
- MLT4 The student will be trained in communications sufficient to serve the needs of patients and the public.
- MLT6 The student will be trained in quality assessment in the laboratory.
- MLT7 The student will be trained in laboratory safety and regulatory compliance.
- MLT8 The student will be trained in information processing in the clinical laboratory.
- MLT9 The student will be trained in ethical and professional conduct.

*Related Academic Standards*

- C1 Interpret written material.
- C2 Interpret visual materials (maps, charts, graphs, tables, etc.).
- C3 Listen, comprehend, and take appropriate actions.
- C4 Access, organize, and evaluate information.
- C5 Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.
- C6 Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.
- M1 Relate number relationships, number systems, and number theory.
- M2 Explore patterns and functions.
- M3 Explore algebraic concepts and processes.
- M4 Explore the concepts of measurement.
- M6 Explore concepts of statistics and probability in real world situations.
- M7 Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.
- S1 Explain the Anatomy and Physiology of the human body.
- S2 Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.
- S6 Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.
- S7 Explore the principles of genetic and molecular Biology to include the relationship between traits and patterns of inheritance, population genetics, the structure and function of DNA, and current applications of DNA technology.
- S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships

between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

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*Workplace Skills for the 21st Century*

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- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

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*National Educational Technology Standards for Students*

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- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

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*Suggested References*

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*Blood and immunity*. (1999). Paradise, CA: CyberEd.

Bryant, N. J. (1992). *Laboratory immunology and serology* (3<sup>rd</sup> ed.). Philadelphia: W. B. Saunders.

Estridge, B. H., Reynolds, A. P., & Walters, N. J. (2000). *Basic medical laboratory techniques* (4<sup>th</sup> ed.). Albany, NY: Delmar.

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Stevens, C. D. (2003). *Clinical immunology and serology: A laboratory perspective* (2<sup>nd</sup> ed.). Philadelphia: F. A. Davis.

Turgeon, M. L. (2003). *Immunology and serology in laboratory medicine* (3<sup>rd</sup> ed.). St. Louis, MO: Mosby.

Zane, H. D. (2001). *Immunology: Theoretical & practical concepts in laboratory medicine*. Philadelphia: W. B. Saunders.

**Course Name:** Clinical Chemistry

**Course Abbreviation:** MLT 1515

**Classification:** Vocational–Technical Core

**Description:** This course is the study of human biochemistry as an aid in the diagnosis of disease processes. It includes chemistry procedures performed on body fluids for aiding in diagnosis of disease processes. (5 sch: 3 hr. lecture, 4 hr. lab)

**Prerequisite:** Approved Chemistry Elective

<b>Competencies and Suggested Objectives</b>	
1.	Describe chemistry test methods used to measure substances in the blood and other body fluids. <ol style="list-style-type: none"> <li>Identify special safety procedures unique to clinical chemistry.</li> <li>Identify and discuss collection procedures and processing of specimens in clinical chemistry.</li> <li>Describe the procedures for specimen collection related to drug screening (chain of command, legal regulation, etc.).</li> <li>Describe the principles of selected chemistry methods to include:               <ol style="list-style-type: none"> <li>spectral techniques</li> <li>competitive binding</li> <li>ion-selective electrodes</li> </ol> </li> <li>Discuss the collection procedures of therapeutic drug monitoring and interpretation of test results.</li> <li>Discuss the uses of computerization in clinical chemistry including specimen identification and data management.</li> <li>Demonstrate data input, storage, and retrieval on a computer.</li> </ol>
2.	Correlate health and disease states with chemistry test results. <ol style="list-style-type: none"> <li>Describe and evaluate diseases and chemistry test results associated with abnormal metabolism including carbohydrate, protein, and lipids.</li> <li>Describe and evaluate diseases and chemistry test results associated with abnormal function including liver, kidney, heart, and endocrine.</li> </ol>
3.	Perform laboratory tests outlined by the test manufacturer to determine the presence and/or amount of substance(s) in the blood and other body fluids. <ol style="list-style-type: none"> <li>Perform selected chemistry tests including manual and semi-automated methods.</li> <li>Demonstrate the operating techniques of the equipment used in the clinical chemistry laboratory, with emphasis on accuracy and precision.</li> <li>Demonstrate calibration of selected instruments and test equipment.</li> <li>Indicate when to refer to an appropriate source for repairs or consultation.</li> </ol>
4.	Solve laboratory mathematics problems. <ol style="list-style-type: none"> <li>Identify and utilize the basic units of measurement in the metric system.</li> <li>List and perform dilution calculations.</li> <li>List and utilize different methods used to state concentrations of substances in clinical chemistry.</li> </ol>

5. Perform quality control procedures as used in the clinical chemistry laboratory with emphasis on accuracy and precision.
  - a. List and describe various statistical methods used in clinical chemistry.
  - b. Prepare quality control (QC) specimens, perform selected assays on QC specimens, and record results.
  - c. Interpret QC data on selected clinical chemistry procedures.
  - d. Document corrective action taken in troubleshooting instruments and out-of-range QC values.

## STANDARDS

### *Standards of Accredited Educational Programs for the Clinical Laboratory Technician/Medical Laboratory Technician*

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|------|---|
| MLT1 | The student will be trained in methodologies for all major areas currently practiced by a modern clinical laboratory, including problem solving and troubleshooting techniques. |
| MLT2 | The student will be trained in collecting, processing, and analyzing biological specimens and other substances.   |
| MLT3 | The student will be trained in laboratory result use in diagnosis and treatment.  |
| MLT4 | The student will be trained in communications sufficient to serve the needs of patients and the public.   |
| MLT6 | The student will be trained in quality assessment in the laboratory.  |
| MLT7 | The student will be trained in laboratory safety and regulatory compliance.   |
| MLT8 | The student will be trained in information processing in the clinical laboratory.   |
| MLT9 | The student will be trained in ethical and professional conduct.  |

### *Related Academic Standards*

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|----|--|
| C1 | Interpret written material.  |
| C2 | Interpret visual materials (maps, charts, graphs, tables, etc.).   |
| C4 | Access, organize, and evaluate information.  |
| C6 | Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.  |
| M1 | Relate number relationships, number systems, and number theory.  |
| M2 | Explore patterns and functions.  |
| M3 | Explore algebraic concepts and processes.  |
| M4 | Explore the concepts of measurement.   |
| M6 | Explore concepts of statistics and probability in real world situations.   |
| S1 | Explain the Anatomy and Physiology of the human body.  |
| S5 | Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry. |
| S6 | Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.  |

- S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

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*Workplace Skills for the 21st Century*

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- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

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*National Educational Technology Standards for Students*

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- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

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*Suggested References*

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- Bishop, M., Fody, E., & Schoeff, L. (2005). *Clinical chemistry: Principles, procedures, correlations* (5<sup>th</sup> ed.). Baltimore: Lippincott Williams & Wilkins.
- Burtis, C. A., & Ashwood, E. R. (2001). *Tietz fundamentals of clinical chemistry* (5<sup>th</sup> ed.). Philadelphia: W. B. Saunders.
- Christenson, R. H., Gregory, L. C., & Johnson, L. J. (2001). *Appleton & Lange's outline review: Clinical chemistry*. New York: Appleton & Lange Reviews/McGraw-Hill.
- Estridge, B. H., Reynolds, A. P., & Walters, N. J. (2000). *Basic medical laboratory techniques* (4<sup>th</sup> ed.). Albany, NY: Delmar.

Kaplan, A. (1994). *Clinical chemistry: Interpretation and techniques* (4<sup>th</sup> ed.). St. Louis, MO: Lea and Febiger.

*Medicomp modules* [Computer software]. (n.d.). Lincoln, VT: Shiesl.

Theriot, B. L. (1999). *Clinical laboratory science review: A bottom line approach* (2<sup>nd</sup> ed.). Jefferson, LA: Creative Educators.

**Course Name:** Principles of Organic and Biochemistry

**Course Abbreviation:** MLT 1523

**Classification:** Vocational–Technical Elective

**Description:** A study of the basic mathematical formulas and organic chemistry (3 sch: 2 hr. lecture, 2 hr. lab)

**Prerequisite:** General Chemistry I (CHE 1213) or Principles of Chemistry I (CHE 1314)

<b>Competencies and Suggested Objectives</b>	
1.	Develop laboratory mathematics skills. <ol style="list-style-type: none"> <li>Work various percentages problems.</li> <li>Work various molarity and normality problems.</li> <li>Work various serial dilution problems.</li> <li>Work specific gravity problems.</li> </ol>
2.	Develop introductory organic chemistry skills. <ol style="list-style-type: none"> <li>Write the general formulas for alkanes, alkenes, and alkynes.</li> <li>Recognize and name alkanes, alkenes, and alkynes structures.</li> <li>Write the general formulas for alcohols, ethers, aldehydes, ketones, carboxylic acids, esters, and amines.</li> <li>Recognize and name alcohols, ethers, aldehydes, ketones, carboxylic acids, esters, and amines.</li> </ol>

## STANDARDS

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- MLT1 The student will be trained in methodologies for all major areas currently practiced by a modern clinical laboratory, including problem solving and troubleshooting techniques.
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- MLT3 The student will be trained in laboratory result use in diagnosis and treatment.
- MLT4 The student will be trained in communications sufficient to serve the needs of patients and the public.
- MLT6 The student will be trained in quality assessment in the laboratory.
- MLT7 The student will be trained in laboratory safety and regulatory compliance.
- MLT8 The student will be trained in information processing in the clinical laboratory.
- MLT9 The student will be trained in ethical and professional conduct.

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*Related Academic Standards*

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- C1 Interpret written material.
- C2 Interpret visual materials (maps, charts, graphs, tables, etc.).
- C4 Access, organize, and evaluate information.
- M1 Relate number relationships, number systems, and number theory.
- M2 Explore patterns and functions.
- M3 Explore algebraic concepts and processes.
- M4 Explore the concepts of measurement.
- M5 Explore the geometry of one-, two-, and three-dimensions.
- M6 Explore concepts of statistics and probability in real world situations.
- M7 Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.
- S1 Explain the Anatomy and Physiology of the human body.
- S5 Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.

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*Workplace Skills for the 21st Century*

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- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.

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*National Educational Technology Standards for Students*

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- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T6 Technology problem-solving and decision-making tools

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*Suggested References*

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- Bishop, M., Fody, E., & Schoeff, L. (2005). *Clinical chemistry: Principles, procedures, correlations* (5<sup>th</sup> ed.). Baltimore: Lippincott Williams & Wilkins.
- Burtis, C. A., & Ashwood, E. R. (2001). *Tietz fundamentals of clinical chemistry* (5<sup>th</sup> ed.). Philadelphia: W. B. Saunders.
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*Medicomp modules* [Computer software]. (n.d.). Lincoln, VT: Shiesl.

Theriot, B. L. (1999). *Clinical laboratory science review: A bottom line approach* (2<sup>nd</sup> ed.). Jefferson, LA: Creative Educators.

**Course Name:** Immunohematology

**Course Abbreviation:** MLT 2424

**Classification:** Vocational–Technical Core

**Description:** This course includes collection, processing, storage, and utilization of blood components. It also includes the study of immunological principles and procedures for blood typing, cross matching, antibody detection, identification, and investigation of hemolytic disease of the newborn. (4 sch: 2 hr. lecture, 4 hr. lab)

**Prerequisite:** Immunology/Serology (MLT 1413)

<b>Competencies and Suggested Objectives</b>	
1. Relate principles of immunology to immunohematology.	<ul style="list-style-type: none"> <li>a. Correlate the immunologic response to the immunohematology theory.</li> <li>b. State antigen and antibody characteristics with reactions in various media and temperatures.</li> </ul>
2. Describe the basic concepts of genetics.	<ul style="list-style-type: none"> <li>a. Apply basic concepts of genetics to various blood group systems.</li> <li>b. Evaluate and interpret inheritance from results of blood bank procedures.</li> <li>c. Determine statistical probability in inheritance of a given characteristic in an individual.</li> </ul>
3. Assess component utilization in transfusion therapy.	<ul style="list-style-type: none"> <li>a. Explain techniques for collection, processing, storage, and shipment of blood components.</li> <li>b. Identify blood component of choice for transfusion therapy.</li> <li>c. Select pre-transfusion compatibility testing procedures required for component therapy.</li> <li>d. Identify types of transfusion reactions and perform investigative testing.</li> <li>e. Assess and perform appropriate tests in investigation of transfusion reactions.</li> </ul>
4. Perform basic procedures used in a blood bank laboratory.	<ul style="list-style-type: none"> <li>a. Assess patient condition to select required procedures for immunohematology.</li> <li>b. Perform and interpret routine pre-transfusion and compatibility patient testing.</li> <li>c. Understand the principles applied for recognition for differentiation of blood group antigens and antibodies.</li> <li>d. Apply the principles of immunohematology to the procedures used in the blood bank laboratory.</li> </ul>
5. Explain, perform, and interpret quality control in the blood bank laboratory.	<ul style="list-style-type: none"> <li>a. Identify and perform the daily quality assurance practices and safety practices used in the blood bank.</li> <li>b. Identify sources of error and recommend corrective procedures.</li> <li>c. Assess physiologic and pathologic causes for discrepant test results.</li> <li>d. Select and employ safe transfusion practices in the presence of unusual test results.</li> </ul>

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- MLT3 The student will be trained in laboratory result use in diagnosis and treatment.
- MLT4 The student will be trained in communications sufficient to serve the needs of patients and the public.
- MLT6 The student will be trained in quality assessment in the laboratory.
- MLT7 The student will be trained in laboratory safety and regulatory compliance.
- MLT8 The student will be trained in information processing in the clinical laboratory.
- MLT9 The student will be trained in ethical and professional conduct.

*Related Academic Standards*

- C1 Interpret written material.
- C2 Interpret visual materials (maps, charts, graphs, tables, etc.).
- C4 Access, organize, and evaluate information.
- C6 Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.
- M1 Relate number relationships, number systems, and number theory.
- M3 Explore algebraic concepts and processes.
- M4 Explore the concepts of measurement.
- M6 Explore concepts of statistics and probability in real world situations.
- S1 Explain the Anatomy and Physiology of the human body.
- S6 Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.
- S7 Explore the principles of genetic and molecular Biology to include the relationship between traits and patterns of inheritance, population genetics, the structure and function of DNA, and current applications of DNA technology.
- S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

*Workplace Skills for the 21st Century*

- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP5 Selects, applies, and maintains/troubleshoots technology.

- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

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*National Educational Technology Standards for Students*

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- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

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*Suggested References*

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- Blaney, K. D., & Howard, P. R. (1999). *Concepts of immunohematology*. St. Louis, MO: Mosby.
- Estridge, B. H., Reynolds, A. P., & Walters, N. J. (2000). *Basic medical laboratory techniques* (4<sup>th</sup> ed.). Albany, NY: Delmar.
- Harmening, D. (1999). *Modern blood banking and transfusion practices*. Philadelphia: F. A. Davis.
- Medicomp modules* [Computer software]. (n.d.). Lincoln, VT: Shiesl.
- Quinley, E. D. (1998). *Immunohematology principles and practice* (2<sup>nd</sup> ed.). Philadelphia: Lippincott Williams & Wilkins.
- Turgeon, M. L. (1995). *Fundamentals of immunohematology* (2<sup>nd</sup> ed.). Media, PA: Williams and Wilkins.
- Walker, R. (2003). *AABB technical manual* (14<sup>th</sup> ed.). Bethesda, MD: American Association of Blood Banks.

**Course Name:** Parasitology

**Course Abbreviation:** MLT 2512

**Classification:** Vocational–Technical Core

**Description:** This course covers the morphology, physiology, life cycles, and epidemiology of parasites with emphasis on human pathogenic parasites. Identification of the parasites from human material is also included. (2 sch: 1 hr. lecture, 2 hr. lab)

**Prerequisite:** None

<b>Competencies and Suggested Objectives</b>	
1.	Describe the life cycle of medically important parasites. <ol style="list-style-type: none"> <li>a. Describe the modes of infection for medically important parasites.</li> <li>b. Recognize the diagnostic stages of medically important parasites.</li> </ol>
2.	Discuss isolation and identification techniques used in a clinical parasitology laboratory. <ol style="list-style-type: none"> <li>a. Identify the various body fluids that might be examined for the presence of parasites.</li> <li>b. Describe the use of concentration techniques in parasitology.</li> <li>c. Describe the microscopic techniques used to identify medically important parasites.</li> </ol>
3.	Identify medically important parasites. <ol style="list-style-type: none"> <li>a. Correlate test results with clinical conditions.</li> <li>b. Correlate other laboratory findings with results in the parasitology laboratory.</li> </ol>

## STANDARDS

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- MLT3 The student will be trained in laboratory result use in diagnosis and treatment.
- MLT4 The student will be trained in communications sufficient to serve the needs of patients and the public.
- MLT6 The student will be trained in quality assessment in the laboratory.
- MLT7 The student will be trained in laboratory safety and regulatory compliance.
- MLT8 The student will be trained in information processing in the clinical laboratory.
- MLT9 The student will be trained in ethical and professional conduct.

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*Related Academic Standards*

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- C1 Interpret written material.
- C2 Interpret visual materials (maps, charts, graphs, tables, etc.).
- C4 Access, organize, and evaluate information.
- C6 Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.
- M1 Relate number relationships, number systems, and number theory.
- S1 Explain the Anatomy and Physiology of the human body.
- S2 Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.
- S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

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*Workplace Skills for the 21st Century*

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- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

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*National Educational Technology Standards for Students*

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- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

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*Suggested References*

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- Ash, L. R., & Orihel, T. C. (1997). *Atlas of human parasitology* (4<sup>th</sup> ed.). Los Angeles, CA: American Society of Clinical Pathology.
- Estridge, B. H., Reynolds, A. P., & Walters, N. J. (2000). *Basic medical laboratory techniques* (4<sup>th</sup> ed.). Albany, NY: Delmar.

Fristische, T. R., Eng, S. C., Curtis, J. D., Davis, D. G., Murray, C., Gammon, C., et al. (1997). *Parasite tutor* [CD-ROM]. Seattle, WA: University of Washington.

Leventhal, R., & Cheadle, R. F. (2002). *Medical parasitology: A self-instructional text*. (5<sup>th</sup> ed.). Philadelphia: F. A. Davis.

*Medicomp modules* [Computer software]. (n.d.). Lincoln, VT: Shiesl.

Peppler, M. S. (2002). *Microbe cards: Medical microbiology and infectious diseases study cards*. Herndon, VA: American Society for Microbiology (ASM) Press.

Theriot, B. L. (1999). *Clinical laboratory science review: A bottom line approach* (2<sup>nd</sup> ed.). Jefferson, LA: Creative Educators.

Zeibig, E. A. (1997). *Wheel of parasitology* [CD-ROM]. Lawrenceville, GA: MediaLab.

**Course Name:** Pathogenic Microbiology

**Course Abbreviation:** MLT 2614

**Classification:** Vocational–Technical Core

**Description:** Basic skills, principles, and techniques for the staining, culturing, isolation, and identification of microorganisms of medical importance are emphasized in this course. Included are techniques used in determining the sensitivity of pathogenic bacteria to different antibiotic and other drugs. (4 sch: 2 hr. lecture, 4 hr. lab)

**Prerequisite:** None

<b>Competencies and Suggested Objectives</b>
1. Discuss transmission methods of disease and host susceptibility. <ol style="list-style-type: none"> <li>Describe the various ways that diseases are transmitted.</li> <li>Identify conditions that lead to increased host susceptibility.</li> <li>Identify a reportable disease.</li> </ol>
2. Identify organisms of medical importance, and correlate results with reading of plates, gram stain reactions, biochemical studies, and molecular studies. <ol style="list-style-type: none"> <li>Correlate laboratory test results with clinical conditions.</li> <li>Evaluate gram stain, colony morphology, and biological and differential tests for identification of pathogenic organisms including AFB and fungus.</li> <li>Perform tests and recognize criteria for identification of pathogenic organisms including AFB and fungus.</li> <li>Identify normal flora at various body sites.</li> </ol>
3. Perform susceptibility testing. <ol style="list-style-type: none"> <li>Compare and contrast the various in-vitro methods for determining antimicrobial susceptibility.</li> <li>Interpret results of in-vitro susceptibility tests as resistant, intermediate, and susceptible.</li> </ol>
4. Perform safety, quality control (QC), and infection control practices of the microbiology laboratory. <ol style="list-style-type: none"> <li>Perform routine diagnostic microbiologic testing using aseptic techniques.</li> <li>Explain and follow safety and universal precautions that are followed in and related to the microbiology laboratory.</li> <li>Perform routine QC procedures.</li> </ol>
5. Explain the principle and operation of automated instrumentation. <ol style="list-style-type: none"> <li>List and discuss examples of automated instrumentation for a microbiology laboratory.</li> </ol>
6. Explain procedures used for collection of microbiologic specimens from various body sites. <ol style="list-style-type: none"> <li>Describe appropriate specimen containers for aseptic collection of microbiological specimens.</li> <li>Explain the collection of specimens from various body sites.</li> </ol>

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- MLT6 The student will be trained in quality assessment in the laboratory.
- MLT7 The student will be trained in laboratory safety and regulatory compliance.
- MLT8 The student will be trained in information processing in the clinical laboratory.
- MLT9 The student will be trained in ethical and professional conduct.

*Related Academic Standards*

- C1 Interpret written material.
- C2 Interpret visual materials (maps, charts, graphs, tables, etc.).
- C4 Access, organize, and evaluate information.
- C6 Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.
- M1 Relate number relationships, number systems, and number theory.
- M3 Explore algebraic concepts and processes.
- M4 Explore the concepts of measurement.
- M6 Explore concepts of statistics and probability in real world situations.
- S1 Explain the Anatomy and Physiology of the human body.
- S2 Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.
- S6 Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.
- S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

*Workplace Skills for the 21st Century*

- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP5 Selects, applies, and maintains/troubleshoots technology.

- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

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*National Educational Technology Standards for Students*

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- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

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*Suggested References*

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- Allen, S. D., Marler, L. M., & Siders, J. A. (1998). *Direct smear atlas* [CD-ROM]. Baltimore: Williams and Wilkins Electronic.
- Asiton, M. L., Ching, A., Cookson, B. T., Curtis, J. D., Fritsche, T. R., McGonagle, L. A., Orkland, A. R., & Pagliaro, L. (1994). *GramStain tutor* [CD-ROM]. Seattle, WA: University of Washington.
- Asiton, M. L., Coyle, M. B., Curtis, J. D., Lafe, K., Murray, C., & Nowowiejski, D. (1998). *Mycology tutor* [CD-ROM]. Seattle, WA: University of Washington.
- Bartelt, M. A. (2000). *Diagnostic bacteriology: A study guide*. Philadelphia: F. A. Davis.
- Delost, M. (1997). *Introduction to diagnostic microbiology: A text and workbook*. St. Louis, MO: Mosby.
- Estridge, B. H., Reynolds, A. P., & Walters, N. J. (2000). *Basic medical laboratory techniques* (4<sup>th</sup> ed.). Albany, NY: Delmar.
- Forbes, B. A., Sahm, D. F., & Weissfeld, A. S. (2002). *Bailey & Scott's diagnostic microbiology* (11<sup>th</sup> ed.). St. Louis, MO: Mosby.
- Germ ware* [CD-ROM]. (1995). Lenexa, KS: CHRISOPE Technologies.
- Howard, B. J., & Keiser, J. F. (1993). *Clinical and pathogenic microbiology* (2<sup>nd</sup> ed.). St. Louis, MO: Mosby.

- Koneman, E. W., Allen, S. D., Janda, W. M., Schreckenberger, P. C., & Winn, W. C. (1997). *Color atlas and textbook of diagnostic microbiology* (5<sup>th</sup> ed.). Philadelphia: Lippincott Williams & Wilkins.
- Mahon, C. R., & Manuselis, G. (2000). *Textbook of diagnostic microbiology*. Philadelphia: W. B. Saunders.
- Medicomp modules* [Computer software]. (n.d.). Lincoln, VT: Shiesl.
- Peppler, M. S. (2002). *Microbe cards: Medical microbiology and infectious diseases study cards*. Herndon, VA: American Society for Microbiology (ASM) Press.
- Shimeld, L. A., & Rodgers, A. T. (1999), *Essentials of diagnostic microbiology*. Albany, NY: Delmar.

**Course Name:** Medical Laboratory Technology Seminar

**Course Abbreviation:** MLT 2711

**Classification:** Vocational–Technical Elective

**Description:** This course represents a synthesis of previous didactic, laboratory, and clinical experiences. It is designed to facilitate activities incorporated in student and professional organizations and to allow students to select and present a case study. (1 sch: 2 hr. lab)

**Prerequisites:** Completion of all didactic Medical Laboratory Technology courses

<b>Competencies and Suggested Objectives</b>	
1.	Demonstrate professionalism and team-building skills by participating in club activities and/or professional organizations. <ol style="list-style-type: none"> <li>a. Attend scheduled club meetings and activities.</li> <li>b. Evaluate the financial needs of a club or organization.</li> </ol>
2.	Present and critique various case studies. <ol style="list-style-type: none"> <li>a. Identify patient from laboratory or clinical experiences with an interesting diagnosis and a clinical course that includes medical laboratory work.</li> <li>b. Present case study to a peer audience.</li> </ol>
3.	Prepare for a certification exam. <ol style="list-style-type: none"> <li>a. Complete a mock certification exam.</li> <li>b. Utilize test results to identify areas of knowledge that should be targeted for further study in preparation for a certification exam.</li> </ol>

## STANDARDS

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MLT4	The student will be trained in communications sufficient to serve the needs of patients and the public.
MLT6	The student will be trained in quality assessment in the laboratory.
MLT7	The student will be trained in laboratory safety and regulatory compliance.
MLT8	The student will be trained in information processing in the clinical laboratory.
MLT9	The student will be trained in ethical and professional conduct.

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*Related Academic Standards*

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- C1 Interpret written material.
- C3 Listen, comprehend, and take appropriate actions.
- C4 Access, organize, and evaluate information.
- C5 Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.
- C6 Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.
- M7 Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.
- S5 Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.
- S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

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*Workplace Skills for the 21st Century*

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- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.

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*National Educational Technology Standards for Students*

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- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

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*Suggested References*

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- Beck, S. J. (2002). *NCA review for the clinical laboratory sciences* (4<sup>th</sup> ed.). Philadelphia: Lippincott Williams & Wilkins.

Castleberry, B. M., Lunz, M. E., Kachin, J. M., & Tanabe, P. A. (1996). *Board of registry study guide for clinical laboratory certification examinations*. Chicago: American Society of Clinical Pathologists.

Estridge, B. H., Reynolds, A. P., & Walters, N. J. (2000). *Basic medical laboratory techniques* (4<sup>th</sup> ed.). Albany, NY: Delmar.

*Medicomp modules* [Computer software]. (n.d.). Lincoln, VT: Shiesl.

Theriot, B. L. (1999). *Clinical laboratory science review: A bottom line approach* (2<sup>nd</sup> ed.). Jefferson, LA: Creative Educators.

**Course Name:** Certification Fundamentals for Medical Laboratory Technology

**Course Abbreviation:** MLT 2723

**Classification:** Vocational–Technical Elective

**Description:** This course is an in-depth study and review of material covered in the MLT curriculum. It is designed to prepare the student for the national registry/certifying exams. (3 sch: 3 hr. lecture)

**Prerequisite:** Completion of all didactic Medical Laboratory Technology courses

<b>Competencies and Suggested Objectives</b>	
1.	Correlate laboratory skills from areas with knowledge obtained from didactic and clinical experiences. <ol style="list-style-type: none"> <li>Recognize and relate disease states with abnormal test results.</li> <li>Demonstrate acceptable proficiency in the cognitive level on all areas tested.</li> <li>Recognize color plate visuals and correlate with each area studied.</li> </ol>
2.	Compare student's pre-testing results in each area with post-testing results. <ol style="list-style-type: none"> <li>Recognize weak areas in knowledge and application.</li> <li>Diagnose strengths and weaknesses in each area by evaluating test results.</li> </ol>
3.	Practice computer constructed tests by using computer software. <ol style="list-style-type: none"> <li>Develop computer skills to enable improved test taking strategies.</li> <li>Analyze the computer-aided testing results and formulate correct responses.</li> </ol>
4.	Correlate registry/certifying item descriptor list with curriculum content. <ol style="list-style-type: none"> <li>Compare registry/certifying item descriptor list with the content of task areas tested.</li> <li>Construct test questions to correlate with item descriptor list.</li> <li>Recognize the three taxonomic levels and practice the utilization of each level.</li> </ol>

## STANDARDS

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MLT9	The student will be trained in ethical and professional conduct.

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*Related Academic Standards*

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- C1 Interpret written material.
- C3 Listen, comprehend, and take appropriate actions.
- C4 Access, organize, and evaluate information.
- C5 Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.
- C6 Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.
- M3 Explore algebraic concepts and processes.
- M4 Explore the concepts of measurement.
- M6 Explore concepts of statistics and probability in real world situations.
- S2 Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.
- S5 Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.
- S6 Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.
- S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

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*Workplace Skills for the 21st Century*

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- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

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*National Educational Technology Standards for Students*

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- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools

T6 Technology problem-solving and decision-making tools

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*Suggested References*

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Ciulla, A. P. (2002). *Q&A review of medical technology/clinical laboratory science* (3<sup>rd</sup> ed.). Upper Saddle River, NJ: Prentice Hall.

Estridge, B. H., Reynolds, A. P., & Walters, N. J. (2000). *Basic medical laboratory techniques* (4<sup>th</sup> ed.). Albany, NY: Delmar.

Harr, R. (2000). *Clinical laboratory science review*. Philadelphia: F. A. Davis.

Leach, D., Ryman, D., & Graves, L. (2004). *Outline review of medical technology*. Upper Saddle River, NJ: Prentice Hall.

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Polansky, V. (2003). *Medical laboratory technology review: Pearls of wisdom* (2<sup>nd</sup> ed.). Lincoln, NE: Boston Medical.

Polansky, V. (2000). *Quick review cards for clinical laboratory science examinations*. Philadelphia: F. A. Davis

Theriot, B. (1999). *Clinical laboratory science review: A bottom line approach* (2<sup>nd</sup> ed.). Jefferson, LA: Creative Educators

**Course Name:** Clinical Instrumentation

**Course Abbreviation:** MLT 2812

**Classification:** Vocational–Technical Elective

**Description:** A review of various types of instruments found in the clinical laboratory is emphasized in this course. Included are operation, calibration, quality control, and troubleshooting. (2 sch: 2 hr. lecture)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1.	Describe the operation and component parts of the following instruments: spectrophotometer, fluorometer, turbidometer, nephelometer, chemiluminescence, and bioluminescence. <ol style="list-style-type: none"> <li>Discuss existing clinical applications for each analytic technique mentioned above.</li> <li>Discuss the limitations of each analytic technique mentioned above.</li> <li>Outline the quality assurance and preventive maintenance procedures involved with the instruments mentioned above.</li> </ol>
2.	Describe the operation and component parts of the following instruments: potentiometers, amperimeters, coulometers, ion selective electrodes, osmometers, electrophoresis, and scintillation counters. <ol style="list-style-type: none"> <li>Discuss existing clinical applications for each analytic technique mentioned above.</li> <li>Discuss the limitations of each analytic technique mentioned above.</li> <li>Outline the quality assurance and preventive maintenance procedures involved with the instruments mentioned above.</li> </ol>
3.	Explain the major steps in automated analysis. <ol style="list-style-type: none"> <li>Discuss automated analysis.</li> <li>Discuss the major steps in automated analysis.</li> </ol>
4.	List and describe the basic approaches to sample analysis used by automated analyzers, including continuous flow, centrifugal, and discrete. <ol style="list-style-type: none"> <li>List and describe the basic approaches to sample analysis used by automated analyzers, including continuous flow.</li> <li>List and describe the basic approaches to sample analysis used by automated analyzers, including centrifugal.</li> <li>List and describe the basic approaches to sample analysis used by automated analyzers, including discrete.</li> </ol>

**STANDARDS***Standards of Accredited Educational Programs for the Clinical Laboratory Technician/Medical Laboratory Technician*

- MLT1 The student will be trained in methodologies for all major areas currently practiced by a modern clinical laboratory, including problem solving and troubleshooting techniques.
- MLT2 The student will be trained in collecting, processing, and analyzing biological specimens and other substances.
- MLT3 The student will be trained in laboratory result use in diagnosis and treatment.
- MLT4 The student will be trained in communications sufficient to serve the needs of patients and the public.
- MLT6 The student will be trained in quality assessment in the laboratory.
- MLT7 The student will be trained in laboratory safety and regulatory compliance.
- MLT8 The student will be trained in information processing in the clinical laboratory.
- MLT9 The student will be trained in ethical and professional conduct.

*Related Academic Standards*

- C1 Interpret written material.
- C2 Interpret visual materials (maps, charts, graphs, tables, etc.).
- C5 Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.
- C6 Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.
- M1 Relate number relationships, number systems, and number theory.
- M2 Explore patterns and functions.
- M3 Explore algebraic concepts and processes.
- M6 Explore concepts of statistics and probability in real world situations.
- S5 Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.
- S6 Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.
- S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

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*Workplace Skills for the 21st Century*

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- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

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*National Educational Technology Standards for Students*

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- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

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*Suggested References*

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- Bishop, M., Fody, E., & Schoeff, L. (2005). *Clinical chemistry: Principles, procedures, correlations* (5<sup>th</sup> ed.). Baltimore: Lippincott Williams & Wilkins.
- Christenson, R. H., Gregory, L. C., & Johnson, L. J. (2001). *Appleton & Lange's outline review: Clinical chemistry*. New York: Appleton & Lange Reviews/McGraw-Hill.
- Estridge, B. H., Reynolds, A. P., & Walters, N. J. (2000). *Basic medical laboratory techniques* (4<sup>th</sup> ed.). Albany, NY: Delmar.
- Medicomp modules* [Computer software]. (n.d.). Lincoln, VT: Shiesl.
- Theriot, B. L. (1999). *Clinical laboratory science review: A bottom line approach* (2<sup>nd</sup> ed.). Jefferson, LA: Creative Educators.

**Course Name:** Clinical Practice I, II, III

**Course Abbreviation:** MLT 2916, MLT 2926, MLT 2936

**Classification:** Vocational–Technical Core

**Description:** This course includes clinical practice and didactic instruction in a clinical affiliate. Areas covered are hematology, clinical chemistry, immunohematology, urinalysis, microbiology, coagulation, and serology. (6 sch: 18 hr. clinical for each Clinical Practice)

**Prerequisites:** All Vocational–Technical Core courses

<b>Competencies and Suggested Objectives</b>	
1.	Process and collect specimens for testing and analysis. <ol style="list-style-type: none"> <li>a. Determine the suitability of specimens submitted for standard laboratory testing.</li> <li>b. Use appropriate protective techniques in collection and processing of laboratory samples.</li> </ol>
2.	Perform analytical examinations on cellular products and body fluids. <ol style="list-style-type: none"> <li>a. Analyze laboratory specimens according to the laboratory procedure manual.</li> <li>b. Apply basic scientific principles in learning new methodologies and techniques.</li> <li>c. Correlate laboratory findings with disease.</li> </ol>
3.	Recognize factors that affect testing procedures and results, and take action when predetermined limits are exceeded. <ol style="list-style-type: none"> <li>a. Specify technical factors influencing test results.</li> <li>b. Assess physical and pathologic causes for variation in test results.</li> <li>c. Interpret laboratory data and follow established protocol when predetermined limits are exceeded.</li> <li>d. Discuss and observe data input, storage, and retrieval on a computer.</li> </ol>
4.	Participate in an established quality control program. <ol style="list-style-type: none"> <li>a. Maintain and monitor an effective quality control program according to laboratory protocol.</li> <li>b. Interpret and evaluate quality control data to determine validity of patient test results.</li> <li>c. Explain corrective action according to laboratory protocol.</li> <li>d. Maintain preventive and corrective maintenance on laboratory equipment and instrumentation, including referral to an appropriate source for repairs and consultation.</li> </ol>
5.	Demonstrate professional conduct, communication, and interpersonal relations with laboratory personnel, patients, other health care professionals, as well as with the public. <ol style="list-style-type: none"> <li>a. Interact and communicate with other laboratory and health care professionals to aid in patient care.</li> <li>b. Recognize the importance of continuing education as an ongoing process.</li> <li>c. Practice measures to protect confidentiality of patient test data.</li> </ol>

6. Demonstrate technical processes sufficient to orient new employees.
  - a. Communicate essential knowledge for job performance to new employees.
  - b. Demonstrate laboratory procedures in order to orient new employees for skills required for the job.
  - c. Practice using evaluation instruments to assess the performance of skills by new employees.

## STANDARDS

### *Standards of Accredited Educational Programs for the Clinical Laboratory Technician/Medical Laboratory Technician*

- |       |   |
|-------|---|
| MLT1  | The student will be trained in methodologies for all major areas currently practiced by a modern clinical laboratory, including problem solving and troubleshooting techniques. |
| MLT2  | The student will be trained in collecting, processing, and analyzing biological specimens and other substances.   |
| MLT3  | The student will be trained in laboratory result use in diagnosis and treatment.  |
| MLT4  | The student will be trained in communications sufficient to serve the needs of patients and the public.   |
| MLT5  | The student will be trained in technical training sufficient to orient new employees.   |
| MLT6  | The student will be trained in quality assessment in the laboratory.  |
| MLT7  | The student will be trained in laboratory safety and regulatory compliance.   |
| MLT8  | The student will be trained in information processing in the clinical laboratory.   |
| MLT9  | The student will be trained in ethical and professional conduct.  |
| MLT10 | The student will be trained in significance of continued professional development.  |

### *Related Academic Standards*

- |    |   |
|----|---|
| C1 | Interpret written material.   |
| C2 | Interpret visual materials (maps, charts, graphs, tables, etc.).  |
| C3 | Listen, comprehend, and take appropriate actions.   |
| C4 | Access, organize, and evaluate information.   |
| C5 | Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement. |
| C6 | Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.         |
| M1 | Relate number relationships, number systems, and number theory.   |
| M3 | Explore algebraic concepts and processes.   |
| M4 | Explore the concepts of measurement.  |
| M6 | Explore concepts of statistics and probability in real world situations.  |
| S1 | Explain the Anatomy and Physiology of the human body.   |
| S2 | Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.                                  |

- S5 Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.
- S6 Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.
- S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

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#### *Workplace Skills for the 21st Century*

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- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

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#### *National Educational Technology Standards for Students*

---

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

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#### *Suggested References*

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- Beck, S. J. (2002). *NCA review for the clinical laboratory sciences* (4<sup>th</sup> ed.). Philadelphia: Lippincott Williams & Wilkins.
- Castleberry, B. M., Lunz, M. E., Kachin, J. M., & Tanabe, P. A. (1996). *Board of registry study guide for clinical laboratory certification examinations*. Chicago: American Society of Clinical Pathologists.
- Estridge, B. H., Reynolds, A. P., & Walters, N. J. (2000). *Basic medical laboratory techniques* (4<sup>th</sup> ed.). Albany, NY: Delmar.

*Medicomp modules* [Computer software]. (n.d.). Lincoln, VT: Shiesl.

Theriot, B. L. (1999). *Clinical laboratory science review: A bottom line approach* (2<sup>nd</sup> ed.). Jefferson, LA: Creative Educators.

## Recommended Tools and Equipment

### CAPITALIZED ITEMS

1. Analyzer, Chemistry, Dry Slide (1 per program)
2. Analyzer, Chemistry, Wet Reagents (1 per program)
3. Analyzer Chemistry Ion Specific Electrode (1 per program)
4. Analyzer, Coagulation (1 per program)
5. Analyzer, Hematology (1 per program)
6. Analyzer, Urine Chemistry (1 per program)
7. Autoclave (1 per program)
8. Bath, Water (1 per 5 students)
9. Blood Bank Gel System (1 per program)
10. Cabinet, Biological Safety (1 per program)
11. Cabinet, Flammable (1 per program)
12. Centrifuge, Cell Washer (1 per lab)
13. Centrifuge, General Lab (2 per lab)
14. Centrifuge, Immunological (1 per student)
15. Centrifuge, Microhematocrit (1 per lab)
16. Chair, Blood Drawing (1 per lab)
17. Computer, CD ROM with Soundcard and DVD (1 per 3 students)
18. Counter, Differential Electronic (1 per student)
19. Fibrometers (1 per lab)
20. Freezer, small (1 per program)
21. Hood, Fume (1 per program)
22. Incubator, CO<sub>2</sub> (1 per lab)
23. Incubator, Dri Bath (small, 1 per student; large, 1 per 4 students)
24. Incubator, General, table top model or stand-alone (1 per lab)
25. Meter, Total Solids (1 per lab)
26. Microscopes, Binocular (1 per student)
27. Microscope, Dual Head (1 per lab)
28. Microscope, Fluorescent (1 per lab)
29. Microscope, Objectives, 40X (1 per student)
30. Microscope, Objectives, 100X (1 per student)
31. Microscope, Objectives, 50X (1 per student)
32. Microscope, Phase Contrast (1 per lab)
33. Microscope Trinocular (1 per lab)
34. Monitor, Cholesterol (1 per program)
35. Ovens, Drying (1 per program)
36. Printer (1 per 2 computers)
37. Refrigerator (commercial, 1 per lab; home, 2 per lab)
38. Refractometer (1 per 5 students)
39. Reader, Capillary Tube (1 per lab)
40. Rotator, Automatic with Timer (1 per lab)
41. System, Electrophoresis (1 per program)
42. Spectrophotometer (1 per 5 students)

43. Stainer, Slide (1 per lab)
44. System, Microbiology ID Sensitivity (manual, 1 per lab)
45. System, Water Purification (1 per program)
46. Tachometer Kit with Recharger (1 per program)
47. TV Monitor (1 per program)
48. VCR (1 per program)
49. Video Monitor and Camera (1 per program)
50. Washer, Glassware (Regular) (0 per new lab)

#### NON-CAPITALIZED ITEMS

1. Arms (1 per 4 students)
2. Blanket, Fire (1 per lab)
3. Box, Rh View (1 per 5 students)
4. Container, Hazardous Waste (small, 1 per 5 students; large, 2 per lab)
5. Counter, Hematologic (1 per student)
6. Counter, Differential Manual (1 per student)
7. Eye Wash Station (1 per lab)
8. Hot Plate with Stirrer (2 per lab)
9. Incinerator, Bacteriologic (1 per student)
10. Jar, Anaerobic system (2 per lab)
11. Microscope, Objectives, 4X (1 per student)
12. Microscope, Objectives, 10X (1 per student)
13. Mixer, Vortex (2 per program)
14. Monitor, Glucose (1 per program)
15. Pipets, Automatic (1 per 2 students)
16. Projector, Overhead (2 per program)
17. Rotator, Tube Rocker (1 per lab)
18. Safety Shower (1 per lab)
19. Scale, Balance (1 per lab)
20. Station, Hazardous Spill (1 per lab)
21. Viewers, Agglutination (1 per student)
22. Washer, Pipette (1 per lab)
23. Timers (1 per student)
24. Glassware, assorted set (1 set per student)
25. Hemacytometer (1 per student)
26. Stopwatches (1 per 2 students)
27. Thermometers (reference, 1 per lab; regular, 5 per lab)
28. Tray, Phlebotomy (1 per 4 students)

#### RECOMMENDED INSTRUCTIONAL AIDS

It is recommended that instructors have access to the following items:

1. Laser Disk Player with Barcode (1 per program)
2. Presentation System (1 per lab)

3. Projector Screen (2 per program)
4. Projector Slide (1 per program)
5. Scanner, Regular and/or Kodachrome
6. Station, MSDS Information (1 per program)

SLIDE OR CD SETS:

1. Blood and Tissue Parasites
2. Body Fluids
3. Clinical Chemistry
4. Immunohematology
5. Immunology/Serology
6. Intestinal Parasites
7. Microbiology
8. Mycology
9. Normal and Abnormal Hematology
10. Protozoa
11. Urinalysis/Sediment

## Student Competency Profile for Medical Laboratory Technology

Student: \_\_\_\_\_

This record is intended to serve as a method of noting student achievement of the competencies in each course. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the program.

In the blank before each competency, place the date on which the student mastered the competency.

### Fundamentals of Medical Laboratory Technology/Phlebotomy (MLT 1111)

- \_\_\_\_\_ 1. Explain the relationship between medical ethics and professionalism to the field of clinical laboratory science.
- \_\_\_\_\_ 2. Recommend and implement currently approved laboratory safety procedures.
- \_\_\_\_\_ 3. Select and use basic equipment to perform selected laboratory skills.
- \_\_\_\_\_ 4. Explain and practice laboratory specimen collection techniques.

### Urinalysis/Body Fluids (MLT 1212)

- \_\_\_\_\_ 1. Describe the formation and composition of urine.
- \_\_\_\_\_ 2. Explain the properties involved in the physical, chemical, and microscopic examinations of urine.
- \_\_\_\_\_ 3. Perform the testing involved in the physical, chemical, and microscopic examinations of urine.
- \_\_\_\_\_ 4. Describe the laboratory testing and the formation of other body fluids (i.e., synovial, CSF, seminal, serous body fluids, amniotic fluids, etc.).

### Hematology I (MLT 1313)

- \_\_\_\_\_ 1. Discuss and identify the origin and characteristics of normal blood cell lines.
- \_\_\_\_\_ 2. Perform routine manual and automated hematology procedures.
- \_\_\_\_\_ 3. Explain the role of hematology safety.
- \_\_\_\_\_ 4. Explain and perform quality assurance procedures and interpret quality control data.
- \_\_\_\_\_ 5. Correlate clinical conditions with hematology test results.

### Hematology II (MLT 1324)

- \_\_\_\_\_ 1. Discuss and identify the origin and characteristics of abnormal blood cells.
- \_\_\_\_\_ 2. Correlate clinical conditions with abnormal hematology laboratory results.
- \_\_\_\_\_ 3. Describe the interaction of blood vessels, platelets, coagulation factors, and fibrinolytic systems in normal and abnormal hemostasis and thrombosis.
- \_\_\_\_\_ 4. Perform and interpret manual and automated hematology and coagulation procedures.

## Immunology/Serology (MLT 1413)

- \_\_\_\_\_1. Describe the body's immune defenses.
- \_\_\_\_\_2. Describe the principles of immunoassays.
- \_\_\_\_\_3. Perform routine immunology/serology procedures with emphasis on accuracy and precision.
- \_\_\_\_\_4. Correlate results of immunological procedures with clinical conditions.

## Clinical Chemistry (MLT 1515)

- \_\_\_\_\_1. Describe chemistry test methods used to measure substances in the blood and other body fluids.
- \_\_\_\_\_2. Correlate health and disease states with chemistry test results.
- \_\_\_\_\_3. Perform laboratory tests outlined by the test manufacturer to determine the presence and/or amount of substance(s) in the blood and other body fluids.
- \_\_\_\_\_4. Solve laboratory mathematics problems.
- \_\_\_\_\_5. Perform quality control procedures as used in the clinical chemistry laboratory with emphasis on accuracy and precision.

## Principles of Organic and Biochemistry (MLT 1523)

- \_\_\_\_\_1. Develop laboratory mathematics skills.
- \_\_\_\_\_2. Develop introductory organic chemistry skills.

## Immunohematology (MLT 2424)

- \_\_\_\_\_1. Relate principles of immunology to immunohematology.
- \_\_\_\_\_2. Describe the basic concepts of genetics.
- \_\_\_\_\_3. Assess component utilization in transfusion therapy.
- \_\_\_\_\_4. Perform basic procedures used in a blood bank laboratory.
- \_\_\_\_\_5. Explain, perform, and interpret quality control in the blood bank laboratory.

## Parasitology (MLT 2512)

- \_\_\_\_\_1. Describe the life cycle of medically important parasites.
- \_\_\_\_\_2. Discuss isolation and identification techniques used in a clinical parasitology laboratory.
- \_\_\_\_\_3. Identify medically important parasites.

## Pathogenic Microbiology (MLT 2614)

- \_\_\_\_\_1. Discuss transmission methods of disease and host susceptibility.
- \_\_\_\_\_2. Identify organisms of medical importance, and correlate results with reading of plates, gram stain reactions, biochemical studies, and molecular studies.
- \_\_\_\_\_3. Perform susceptibility testing.

- \_\_\_\_\_4. Perform safety, quality control (QC), and infection control practices of the microbiology laboratory.
- \_\_\_\_\_5. Explain the principle and operation of automated instrumentation.
- \_\_\_\_\_6. Explain procedures used for collection of microbiologic specimens from various body sites.

#### Medical Laboratory Technology Seminar (MLT 2711)

- \_\_\_\_\_1. Demonstrate professionalism and team-building skills by participating in club activities and/or professional organizations.
- \_\_\_\_\_2. Present and critique various case studies.
- \_\_\_\_\_3. Prepare for a certification exam.

#### Certification Fundamentals for Medical Laboratory Technology (MLT 2723)

- \_\_\_\_\_1. Correlate laboratory skills from areas with knowledge obtained from didactic and clinical experiences.
- \_\_\_\_\_2. Compare student's pre-testing results in each area with post-testing results.
- \_\_\_\_\_3. Practice computer constructed tests by using computer software.
- \_\_\_\_\_4. Correlate registry/certifying item descriptor list with curriculum content.

#### Clinical Instrumentation (MLT 2812)

- \_\_\_\_\_1. Describe the operation and component parts of the following instruments: spectrophotometer, fluorometer, turbidimeter, nephelometer, chemiluminescence, and bioluminescence.
- \_\_\_\_\_2. Describe the operation and component parts of the following instruments: potentiometers, amperimeters, coulometers, ion selective electrodes, osmometers, electrophoresis, and scintillation counters.
- \_\_\_\_\_3. Explain the major steps in automated analysis.
- \_\_\_\_\_4. List and describe the basic approaches to sample analysis used by automated analyzers, including continuous flow, centrifugal, and discrete.

#### Clinical Practice I, II, III (MLT 2916, MLT 2926, MLT 2936)

- \_\_\_\_\_1. Process and collect specimens for testing and analysis.
- \_\_\_\_\_2. Perform analytical examinations on cellular products and body fluids.
- \_\_\_\_\_3. Recognize factors that affect testing procedures and results, and take action when predetermined limits are exceeded.
- \_\_\_\_\_4. Participate in an established quality control program.
- \_\_\_\_\_5. Demonstrate professional conduct, communication, and interpersonal relations with laboratory personnel, patients, other health care professionals, as well as with the public.
- \_\_\_\_\_6. Demonstrate technical processes sufficient to orient new employees.

## Baseline Competencies

The following competencies and suggested objectives are taken from the publication *Mississippi Curriculum Framework for Secondary Allied Health*. These competencies and objectives represent the baseline for entrance into the postsecondary Medical Laboratory Technology courses. Students enrolled in postsecondary courses should either (1) have documented mastery of these competencies, or (2) be provided with these competencies before studying the advanced competencies in the Medical Laboratory Technology program.

Baseline competencies may be integrated into existing courses in the curriculum or taught as special “Introduction” courses. The “Introduction” courses may be taught for up to six semester hours of institutional credit and may be divided into two courses. If the Baseline Competencies are to be taught as “Introduction” courses, each course should be at least 3 credit hours. The following course number(s) and description should be used:

**Course Name(s):** Introduction to Medical Laboratory Technology, Introduction to Medical Laboratory Technology I, or Introduction to Medical Laboratory Technology II

**Course Abbreviation(s):** MLT 100(3-6), MLT 1013, MLT 1023

**Classification:** Vocational-Technical Core

**Description:** These courses contain the baseline competencies and suggested objectives from the high school Allied Health curriculum which directly relate to the community college Medical Laboratory Technology program. The courses are designed for students entering the community college who have had no previous training or documented experience in the field. (3-6 semester hours based upon existing skills for each student. May be divided into 2 courses for a maximum total of 6 hours of institutional credit.)

### Competencies and Suggested Objectives

1. Review material related to course and professional organizations.
  - a. Identify student and course expectations.
  - b. Identify allied health professional student organizations and their roles in individual career development.
  - c. Compare the timeline of medical history.
2. Explain effective communication skills.
  - a. Identify the main factors required for the communication process.
  - b. Identify factors which can interfere with the communication process.
  - c. Demonstrate effective teamwork skills.
  - d. Explore professional literature and medical references.
3. Discuss professional ethics.
  - a. Explain professional ethics.
  - b. Discuss confidentiality.
  - c. Discuss HIPPA, the Health Insurance Portability and Accountability Act of 1996.

4. Discuss legal responsibility and client's rights.
  - a. Explain torts and legal responsibility.
  - b. Identify ways to promote client's rights and privacy.
  - c. Discuss the requirement for health care workers to undergo a background check.
5. Explain standard precautions.
  - a. Explain importance of standard precautions in life practices and health care.
  - b. Explain the state and federal government's role in standard precautions.
  - c. Relate standard precautions to the transmission of infectious diseases including HIV, AIDS, HBV, and TB.
6. Utilize standard precautions.
  - a. Demonstrate hand-washing techniques.
  - b. Demonstrate donning and removing clean gloves.
7. Recognize safety procedures and policies.
  - a. Describe basic safety procedures.
  - b. Describe accident prevention methods and disaster plans of the local school district.
  - c. Discuss a safe and clean environment.
  - d. Follow state and facility guidelines, including dress requirements for clinical-type experiences.
8. Perform basic emergency procedures.
  - a. Explain first aid procedures for sudden illness.
  - b. Explain first aid procedures for accidents.
9. Perform advanced emergency procedures.
  - a. Perform CPR.
  - b. Demonstrate first aid for an obstructed airway.
10. Explain medical terminology.
  - a. Spell designated medical terms correctly.
  - b. Demonstrate the use of medical references to spell medical terms correctly.
  - c. Define and divide medical terms into root words, prefixes, and suffixes.
11. Recognize and use medical terminology.
  - a. Interpret the common medical abbreviations and symbols including meanings, and uses.
  - b. Demonstrate the use of medical terms and abbreviations in reading, speaking, interpreting, and writing simulated medical records.
12. Identify ways pathogenic microorganisms are spread in relation to the infection cycle.
  - a. Review the integumentary system.
  - b. Define terms related to infection control and asepsis.
  - c. Define general principles, purposes, and types of isolation.
  - d. Demonstrate how to don and remove isolation garments and equipment.
  - e. Describe basic methods of sterilization and disinfection.
  - f. Discuss concurrent and terminal cleaning of a patient unit.
13. Describe careers in the medical laboratory.
  - a. Compare job descriptions in the field.
  - b. Differentiate educational levels and credentials required.

14. Explore medical lab procedures and circumstances requiring use.
  - a. Review the urinary system.
  - b. Describe methods of collecting specimens of urine, stool, sputum, blood, and emesis.
  - c. Identify basic lab tests.
  - d. Observe basic laboratory procedures.
15. Demonstrate job seeking skills.
  - a. Prepare a resume containing essential information utilizing word processing software.
  - b. Complete a job application form on paper or online.
  - c. Discuss procedures for job interviews.
  - d. Demonstrate the role of an applicant in a job interview.
  - e. Describe job interview etiquette.
16. Explain job keeping skills.
  - a. Discuss positive relations with clients and peers.
  - b. Write a letter of resignation.

**Appendix A: Standards of Accredited Educational Programs for the Clinical Laboratory Technician/Medical Laboratory Technician by the National Accrediting Agency for Clinical Laboratory Sciences<sup>1</sup>**

- MLT1 The student will be trained in methodologies for all major areas currently practiced by a modern clinical laboratory, including problem solving and troubleshooting techniques.
- MLT2 The student will be trained in collecting, processing, and analyzing biological specimens and other substances.
- MLT3 The student will be trained in laboratory result use in diagnosis and treatment.
- MLT4 The student will be trained in communications sufficient to serve the needs of patients and the public.
- MLT5 The student will be trained in technical training sufficient to orient new employees.
- MLT6 The student will be trained in quality assessment in the laboratory.
- MLT7 The student will be trained in laboratory safety and regulatory compliance.
- MLT8 The student will be trained in information processing in the clinical laboratory.
- MLT9 The student will be trained in ethical and professional conduct.
- MLT10 The student will be trained in significance of continued professional development.

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<sup>1</sup> *Standards of accredited educational programs for the clinical laboratory technician/medical laboratory technician.* Retrieved September 27, 2004, from <http://www.naacls.org>

## Appendix B: Related Academic Standards

### RELATED ACADEMIC TOPICS FOR COMMUNICATIONS

- C1 Interpret written material.
- C2 Interpret visual materials (maps, charts, graphs, tables, etc.).
- C3 Listen, comprehend, and take appropriate actions.
- C4 Access, organize, and evaluate information.
- C5 Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.
- C6 Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.

### EXPANDED TOPICS FOR COMMUNICATIONS

TOPIC C1: Interpret written material.

- C1.01 Read and follow complex written directions.
- C1.02 Recognize common words and meanings associated with a variety of occupations.
- C1.03 Adjust reading strategy to purpose and type of reading.
- C1.04 Use sections of books and reference sources to obtain information.
- C1.05 Compare information from multiple sources and check validity.
- C1.06 Interpret items and abbreviations used in multiple forms.
- C1.07 Interpret short notes, memos, and letters.
- C1.08 Comprehend technical words and concepts.
- C1.09 Use various reading techniques depending on purpose for reading.
- C1.10 Find, read, understand, and use information from printed matter or electronic sources.

TOPIC C2: Interpret visual materials (maps, charts, graphs, tables, etc.).

- C2.01 Use visuals in written and in oral presentations.
- C2.02 Recognize visual cues to meaning (layout, typography, etc.).
- C2.03 Interpret and apply information using visual materials.

TOPIC C3: Listen, comprehend, and take appropriate action.

- C3.01 Identify and evaluate orally-presented messages according to purpose.
- C3.02 Recognize barriers to effective listening.
- C3.03 Recognize how voice inflection changes meaning.
- C3.04 Identify speaker signals requiring a response and respond accordingly.
- C3.05 Listen attentively and take accurate notes.
- C3.06 Use telephone to receive information.
- C3.07 Analyze and distinguish information from formal and informal oral presentations.

TOPIC C4: Access, organize, and evaluate information.

- C4.01 Distinguish fact from opinion.
- C4.02 Use various print and non-print sources for specialized information.
- C4.03 Interpret and distinguish between literal and figurative meaning.
- C4.04 Interpret written or oral communication in relation to context and writer's point of view.
- C4.05 Use relevant sources to gather information for written or oral communication.
- TOPIC C5: Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.
- C5.01 Select appropriate words for communication needs.
- C5.02 Use reading, writing, listening, and speaking skills to solve problems.
- C5.03 Compose inquiries and requests.
- C5.04 Write persuasive letters and memos.
- C5.05 Edit written reports, letters, memos, and short notes for clarity, correct grammar, and effective sentences.
- C5.06 Write logical and understandable statements, phrases, or sentences for filling out forms, for correspondence or reports.
- C5.07 Write directions or summaries of processes, mechanisms, events, or concepts.
- C5.08 Select and use appropriate formats for presenting reports.
- C5.09 Convey information to audiences in writing.
- C5.10 Compose technical reports and correspondence that meet accepted standards for written communications.
- TOPIC C6: Communicate ideas and information using oral and written forms for a variety of audiences and purposes.
- C6.01 Give complex oral instructions.
- C6.02 Describe a business or industrial process/mechanism.
- C6.03 Participate effectively in group discussions and decision making.
- C6.04 Produce effective oral messages utilizing different media.
- C6.05 Explore ideas orally with partners.
- C6.06 Participate in conversations by volunteering information when appropriate and asking relevant questions when appropriate.
- C6.07 Restate or paraphrase a conversation to confirm one's own understanding.
- C6.08 Gather and provide information utilizing different media.
- C6.09 Prepare and deliver persuasive, descriptive, and demonstrative oral presentations.

### **RELATED ACADEMIC TOPICS FOR MATHEMATICS**

- M1 Relate number relationships, number systems, and number theory.
- M2 Explore patterns and functions.
- M3 Explore algebraic concepts and processes.
- M4 Explore the concepts of measurement.

- M5 Explore the geometry of one-, two-, and three-dimensions.
- M6 Explore concepts of statistics and probability in real world situations.
- M7 Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.

## EXPANDED TOPICS FOR MATHEMATICS

TOPIC M1: Relate number relationships, number systems, and number theory.

- M1.01 Understand, represent, and use numbers in a variety of equivalent forms (integer, fraction, decimal, percent, exponential, and scientific notation) in real world and mathematical problem situations.
- M1.02 Develop number sense for whole numbers, fractions, decimals, integers, and rational numbers.
- M1.03 Understand and apply ratios, proportions, and percents in a wide variety of situations.
- M1.04 Investigate relationships among fractions, decimals, and percents.
- M1.05 Compute with whole numbers, fractions, decimals, integers, and rational numbers.
- M1.06 Develop, analyze, and explain procedures for computation and techniques for estimations.
- M1.07 Select and use an appropriate method for computing from among mental arithmetic, paper-and-pencil, calculator, and computer methods.
- M1.08 Use computation, estimation, and proportions to solve problems.
- M1.09 Use estimation to check the reasonableness of results.

TOPIC M2: Explore patterns and functions.

- M2.01 Describe, extend, analyze, and create a wide variety of patterns.
- M2.02 Describe and represent relationships with tables, graphs, and rules.
- M2.03 Analyze functional relationships to explain how a change in one quantity results in a change in another.
- M2.04 Use patterns and functions to represent and solve problems.
- M2.05 Explore problems and describe results using graphical, numerical, physical, algebraic, and verbal mathematical models or representations.
- M2.06 Use a mathematical idea to further their understanding of other mathematical ideas.
- M2.07 Apply mathematical thinking and modeling to solve problems that arise in other disciplines, such as art, music, and business.

TOPIC M3: Explore algebraic concepts and processes.

- M3.01 Represent situations and explore the interrelationships of number patterns with tables, graphs, verbal rules, and equations.
- M3.02 Analyze tables and graphs to identify properties and relationships and to interpret expressions and equations.

- M3.03 Apply algebraic methods to solve a variety of real world and mathematical problems.
- TOPIC M4: Explore the concepts of measurement.
- M4.01 Estimate, make, and use measurements to describe and compare phenomena.  
M4.02 Select appropriate units and tools to measure to the degree of accuracy required in a particular situation.  
M4.03 Extend understanding of the concepts of perimeter, area, volume, angle measure, capacity, and weight and mass.  
M4.04 Understand and apply reasoning processes, with special attention to spatial reasoning and reasoning with proportions and graphs.
- TOPIC M5: Explore the geometry of one-, two-, and three-dimensions.
- M5.01 Identify, describe, compare, and classify geometric figures.  
M5.02 Visualize and represent geometric figures with special attention to developing spatial sense.  
M5.03 Explore transformations of geometric figures.  
M5.04 Understand and apply geometric properties and relationships.  
M5.05 Classify figures in terms of congruence and similarity and apply these relationships.
- TOPIC M6: Explore the concepts of statistics and probability in real world situations.
- M6.01 Systematically collect, organize, and describe data.  
M6.02 Construct, read, and interpret tables, charts, and graphs.  
M6.03 Develop an appreciation for statistical methods as powerful means for decision making.  
M6.04 Make predictions that are based on exponential or theoretical probabilities.  
M6.05 Develop an appreciation for the pervasive use of probability in the real world.
- TOPIC M7: Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.
- M7.01 Use computers and/or calculators to process information for all mathematical situations.  
M7.02 Use problem-solving approaches to investigate and understand mathematical content.  
M7.03 Formulate problems from situations within and outside mathematics.  
M7.04 Generalize solutions and strategies to new problem situations.

**RELATED ACADEMIC TOPICS FOR SCIENCE**

- S1 Explain the Anatomy and Physiology of the human body.
- S2 Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.
- S3 Relate the nine major phyla of the kingdom animalia according to morphology, anatomy, and physiology.
- S4 Explore the chemical and physical properties of the earth to include Geology, Meteorology, Oceanography, and the Hydrologic Cycle.
- S5 Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.
- S6 Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.
- S7 Explore the principles of genetic and molecular Biology to include the relationship between traits and patterns of inheritance, population genetics, the structure and function of DNA, and current applications of DNA technology.
- S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

**EXPANDED TOPICS FOR SCIENCE**

- TOPIC S1: Explain the Anatomy and Physiology of the human body.
- S1.01 Recognize common terminology and meanings.
- S1.02 Explore the relationship of the cell to more complex systems within the body.
- S1.03 Summarize the functional anatomy of all the major body systems.
- S1.04 Relate the physiology of the major body systems to its corresponding anatomy.
- S1.05 Compare and contrast disease transmission and treatment within each organ system.
- S1.06 Explore the usage of medical technology as related to human organs and organ systems.
- S1.07 Explain the chemical composition of body tissue.
- TOPIC S2: Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.
- S2.01 Identify the major types and structures of plants, viruses, monera, algae protista, and fungi.
- S2.02 Explain sexual and asexual reproduction.
- S2.03 Describe the ecological importance of plants as related to the environment.
- S2.04 Analyze the physical chemical and behavioral process of a plant.

- TOPIC S3: Relate the nine major phyla of the kingdom animalia according to morphology, anatomy, and physiology.
- S3.01 Explain the morphology, anatomy, and physiology of animals.  
S3.02 Describe the characteristics, behaviors, and habitats of selected animals.
- TOPIC S4: Explore the chemical and physical properties of the earth to include Geology, Meteorology, Oceanography, and the Hydrologic Cycle.
- S4.01 Examine minerals and their identification, products of the rock cycle, byproducts of weathering, and the effects of erosion.  
S4.02 Relate the Hydrologic Cycle to include groundwater its zones, movement, and composition; surface water systems, deposits, and runoff.  
S4.03 Consider the effects of weather and climate on the environment.  
S4.04 Examine the composition of seawater; wave, tides, and currents; organisms, environment, and production of food; energy, food and mineral resources of the oceans.
- TOPIC S5: Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.
- S5.01 Examine the science of chemistry to include the nature of matter, symbols, formulas and nomenclature, and chemical equations.  
S5.02 Identify chemical reactions including precipitation, acids-bases, and reduction-oxidation.  
S5.03 Explore the fundamentals of chemical bonding and principles of equilibrium.  
S5.04 Relate the behavior of gases.  
S5.05 Investigate the structure, reactions, and uses of organic compounds; and investigate nuclear chemistry and radiochemistry.
- TOPIC S6: Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.
- S6.01 Examine fundamentals of motion of physical bodies and physical dynamics.  
S6.02 Explore the concepts and relationships among work, power, and energy.  
S6.03 Explore principles, characteristics, and properties of electricity, magnetism, light energy, thermal energy, and wave energy.  
S6.04 Identify principles of modern physics related to nuclear physics.
- TOPIC S7: Explore the principles of genetic and molecular Biology to include the relationship between traits and patterns of inheritance; population genetics, the structure and function of DNA, and current applications of DNA technology.

- S7.01 Examine principles, techniques, and patterns of traits and inheritance in organisms.
- S7.02 Apply the concept of population genetics to both microbial and multicellular organism.
- S7.03 Identify the structure and function of DNA and the uses of DNA technology in science, industry, and society.
- TOPIC S8: Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.
- S8.01 Apply the components of scientific processes and methods in classroom and laboratory investigations.
- S8.02 Observe and practice safe procedures in the classroom and laboratory.
- S8.03 Demonstrate proper use and care for scientific equipment.
- S8.04 Investigate science careers, and advances in technology.
- S8.05 Communicate results of scientific investigations in oral, written, and graphic form.

## Appendix C: Workplace Skills for the 21<sup>st</sup> Century<sup>2</sup>

- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

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<sup>2</sup> Secretary's commission on achieving necessary skills. (1991). Retrieved July 13, 2004, from <http://wdr.doleta.gov/SCANS/>

## Appendix D: National Educational Technology Standards for Students<sup>3</sup>

- T1 Basic operations and concepts
- Students demonstrate a sound understanding of the nature and operation of technology systems.
  - Students are proficient in the use of technology.
- T2 Social, ethical, and human issues
- Students understand the ethical, cultural, and societal issues related to technology.
  - Students practice responsible use of technology systems, information, and software.
  - Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity.
- T3 Technology productivity tools
- Students use technology tools to enhance learning, increase productivity, and promote creativity.
  - Students use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works.
- T4 Technology communications tools
- Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.
  - Students use a variety of media and formats to communicate information and ideas effectively to multiple audiences.
- T5 Technology research tools
- Students use technology to locate, evaluate, and collect information from a variety of sources.
  - Students use technology tools to process data and report results.
  - Students evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks.
- T6 Technology problem-solving and decision-making tools
- Students use technology resources for solving problems and making informed decisions.
  - Students employ technology in the development of strategies for solving problems in the real world.

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<sup>3</sup> ISTE: *National educational technology standards (NETS)*. (2000). Retrieved July 13, 2004, from <http://cnets.iste.org/>