I. INTRODUCTION

A. Introduction to Clinical Laboratory Sciences and Urinalysis are courses designed to provide an overview of medical laboratory technology as a career field. It includes the following: safety, metric system, medical terminology, microscopy, phlebotomy, and the basics of hematology, immunology, chemistry and microbiology. An Introduction of Urinalysis includes: the anatomy and physiology of the kidney, physical, chemical and microscopic examination of urine. Body fluids are covered in MLAB 1470-Introduction to clinical Laboratory Science/Urinalysis & Body Fluids.

B. The courses are designed to meet basic curriculum requirements for the Central Texas College Medical Laboratory Technician Program.

C. This course is occupationally related and provided didactic and practical knowledge required for entrance into the clinical portions of the Medical Laboratory Technology Program.

D. Prerequisite(s): None

II. LEARNING OUTCOMES

Upon successful completion of the courses, Introduction to Clinical Laboratory Science and Urinalysis, the student will be able to:

A. Describe the role of the medical laboratory technician as a health care professional.

B. Utilize appropriate safety equipment and procedures according to established laboratory protocol and regulatory compliance.

C. List and explain the function of the various parts of a microscope.

D. Demonstrate a basic knowledge of medical terminology.

E. Exhibit the professional and ethical attributes required by the medical laboratory technician.
F. Perform quality control (QC) procedures according to established protocol and evaluate the results.

G. Demonstrate laboratory techniques in microscopy, urinalysis, phlebotomy, microbiology, serology, and chemistry.

H. Relate the clinical significance of laboratory procedures to the appropriate disease process. Correlate values with given disease states, diagnosis, and treatment.

I. At the conclusion of this lecture series, the student will have achieved the following: Achievement will be met when a minimum score of 75 percent is earned on the written examination covering the material.

III. INSTRUCTIONAL MATERIALS

The instructional materials identified for this course are viewable through www.ctcd.edu/books

IV. COURSE REQUIREMENTS

A. To receive transferable credits for this course, you must earn a grade of 2.5 or better.

B. Class attendance is mandatory. A student who is late for 15 minutes or more will be marked absent. A student who is late for less than 15 minutes late will be marked tardy. 2 tardy will count as an absence. 3 absences result in loss of a letter grade for the course. 4 absences will disqualify a student from the MLT program and the student will be required to meet with the program director for readmission.

C. Students with a grade of 2.4 or less should make an appointment with the instructor to discuss the reason for low performance. Any material not understood by the student can be discussed with the instructor privately during office hours. Office hours are posted; please try to schedule an appointment at your convenience.

D. Lecture examinations will be taken from class notes, assigned pages in your text, and any additional information such as computer assignments or videos.

E. Laboratory examinations will be taken from a combination of lecture and any laboratory information covered in any format. Often theory of procedures is required to perform the procedure and evaluate your results.

V. EXAMINATIONS
A. Five lecture, three laboratory examinations, and laboratory assessment will be given. A comprehensive final examination will be given.

B. Makeup examinations will not be given. If you must miss an exam, you can use your final exam grade to replace your missed exam grade. Any additional missed exams would result in a “0” and cannot be made up.

VI. SEMESTER GRADE COMPUTATION

<table>
<thead>
<tr>
<th>*Lecture Examinations</th>
<th>Point Value</th>
<th>*Laboratory Examinations</th>
<th>Point Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture 1</td>
<td>100</td>
<td>Laboratory 1</td>
<td>100</td>
</tr>
<tr>
<td>Lecture 2</td>
<td>100</td>
<td>Laboratory 2</td>
<td>100</td>
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<tr>
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<td>Lecture 4</td>
<td>100</td>
<td>Laboratory Assessment</td>
<td>100*Professional</td>
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<tr>
<td>Lecture 5</td>
<td>100</td>
<td>Total Lab Points Possible</td>
<td>400</td>
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<tr>
<td>Quizzes</td>
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Total Lecture Points Possible 600

Final Examination 200

Total Lecture/Lab/Final Points Possible 1200

<table>
<thead>
<tr>
<th>Number of Points</th>
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<tr>
<td>1080-1200</td>
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<td>D</td>
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<tr>
<td>720 – Below</td>
<td>F</td>
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</tbody>
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NOTE: Plagiarism in any form will **not** be tolerated. A student who chooses to plagiarize will be given a zero on the assignment. A formal charge may be made to the College Disciplinary Board.  
*Ten clean AS100 scan Tron answer sheets will be required for lecture, lab, and final exams. Those will be given to the instructor during the 1st week of classes.

NOTE: Cheating in any form will not be tolerated. A student observed cheating will be given a zero on the test. A formal charge may be made to the College Disciplinary Board.

**Professionalism Grade: 50 Points (This grade cannot be replaced by final)**
Grading for Professionalism Grade: Subtract 2 pts per tardy or absence, 1 pt for other infractions  
Includes:  
Preparation for Class  
Completion of assignments (Homework assignments: Full credit at start of class, half points at end of day, 0 points after 1st day. See attendance below.)  
Attendance (Must bring a doctor’s note for each absence due to illness to accept assignments the following day)  
Tardies
Unlawful Use of electronics (cell phones, etc)
Observation (Team player, Participation, Stay on Task –minimal Distractions, cheating, plagiarism, talking)

Extra credit: Maximum of 3% of total grade. Extra credit for lecture portion only. Lab has lab participation points. No extra assignments without approval of professor for lecture. Again, must fit within 3% of total extra points.

Testing: If professor elects to use testing center, tests will only be available on Tues-Thursday only. No exceptions. Tests will only be for same time period as the class. Class must meet during original scheduled class time for extra lectures and/or labs. Professor will take test on Monday, pick up tests on Friday to be able to grade by next class period.

VII. NOTES AND ADDITIONAL INSTRUCTIONS FROM THE INSTRUCTOR

A. **Course Withdrawal:** It is the student’s responsibility to officially withdraw from a class if circumstances prevent attendance. Any student who desires to, or must, officially withdraw from a course after the first scheduled class meeting must file a Central Texas College Application for Withdrawal (CTC Form 59). The withdrawal form must be signed by the student.

CTC Form 59 will be accepted at any time prior to Friday of the 12th week of classes during the 16-week fall and spring semesters. The deadline for sessions of other lengths is as follows:

- **10-week session**
  - Friday of the 7th week
- **8-week session**
  - Friday of the 6th week
- **5-week session**
  - Friday of the 3rd week

The equivalent date (75% of the semester) will be used for other sessions of other lengths. The specific last day to withdrawal is published each semester in the Schedule Bulletin.

A student who officially withdraws will be awarded the grade of “W” provided the student’s attendance and academic performance are satisfactory at the time of official withdrawal. Students must file a withdrawal application with the college before they may be considered for withdrawal.

A student may not withdraw from a class for which the instructor has previously issued the student a grade of “F” or “FN” for nonattendance.

B. **Administrative Withdrawal:** An administrative withdrawal may be initiated when the student fails to meet College attendance requirements. The instructor will assign the appropriate grade on CTC Form 59 for submission to the registrar.

C. **Incomplete Grade:** The College catalog states, “An incomplete grade may be given in those cases where the student has completed the majority of the course work but, because of personal illness, death in the immediate family, or military orders, the student is unable to complete the requirements for a course…” Prior
approval from the instructor is required before the grade of “I” for Incomplete is recorded. A student who merely fails to show for the final examination will receive a zero for the final and an “F” for the course.

D. **Cellular Phones and Beepers**: Student cellular phones and beepers will be turned off while the student is in the classroom or laboratory. Students choosing to disregard this policy will be asked to leave and will be recorded as absent. If a cell phone rings or is used during testing, the test will be taken and a grade of zero will be given.

E. **American’s with Disabilities Act (ADA)**: Disability Support Services provide services to students who have appropriate documentation of a disability. Students requiring accommodations for class are responsible for contacting the Office of Disability Support Services (DSS) located on the central campus. This service is available to all students, regardless of location. Explore the website at [www.ctcd.edu/disability-support](http://www.ctcd.edu/disability-support) for further information. Reasonable accommodations will be given in accordance with the federal and state laws through the DSS office.

F. **Instructor Discretion**: The instructor reserves the right or final decision in course requirements.

G. **Civility**: The collegiate expectation is that students will conduct themselves with civility at all times in classrooms. Minimal civility includes:
   a. Being in class on time
   b. Staying in class for the entire class period
   c. Leaving early occurs only after informing the teacher, prior to class, of an unavoidable conflict requiring your early departure (if possible, position yourself close to the door for a minimum disruption of the class)
   d. Avoiding such uncivil conduct as talking, sleeping, reading papers/magazines, or working on some other class homework assignment
   e. Using socially acceptable language in classroom discussions
      Failure to do so can result in disciplinary action up to and including expulsion.

VIII. **COURSE OUTLINE**

A. **Unit One: Introduction to Clinical Laboratory Science, Safety, Microscope, and Lab Math Part 1**:

1. **Learning Outcomes**: Upon completion of this lesson, the student will be able to:
   a. Explain the purpose and benefits of professional societies
   b. Describe the role of the medical laboratory technician as a part of the health care team
c. List and describe the various discipline areas in the clinical laboratory
d. Demonstrate knowledge of medical terminology
e. Identify the various parts of a binocular microscope and the types of microscopy.
f. Explain the function of the various parts of the microscope, equipment, and reagents used with the microscope.
g. Correctly focus and identify preserved specimens on low, high, and oil magnifications, and understand how to calculate total magnification. Explain parfocal, and numerical aperture.
h. State the definition of ethics as applied to the laboratory professional
i. Demonstrate knowledge of the Patient’s Bill of Rights
j. Perform laboratory activities using safe laboratory behavior and regulatory compliance.
k. List potential hazards in the clinical laboratory including biological, chemical, fire, electrical, mechanical, physical, and radiation hazards
l. Identify safety features in the student and clinical laboratory. Explain how safety practices are ensured.
m. List the importance of quality assurance in the clinical laboratory
n. List the purpose, functions, and uses of laboratory information systems. Perform basic operations of computer systems
o. Perform metric measurements and conversions
p. Explain the importance of a QC program including QC samples, range, and charts. Explain the need for standardization in lab practice.
q. Demonstrate correct and safe use of lab equipment, microscope, and glassware. Demonstrate accurate measurement of liquids. Choose appropriate equipment for the measurement. Prepare dilutions. Define solute, solvent, solution and dilution.
r. Demonstrate knowledge of laboratory chain of command.
s. Choose appropriate mode of transmission for laboratory activities.
t. Classify correct phase of lab testing.
u. Exhibit a sense of professionalism by demonstrating the following characteristics: attend class regularly and punctually, seeks activities which further learning, admits mistakes and takes steps to correct them, repeats procedures when test result is in doubt, cooperates with instructor, takes pride in laboratory medicine, complies with the stated dress code of the student laboratory, and recognizes the value of continuing education activities
v. At the conclusion of this lecture series, the student will have achieved the following: Achievement will be met when a minimum score of 75 percent is earned on the written examination covering the material.
2. **Learning Activities**: Methods of Teaching and Learning
   Students will be taught using various learning methods and activities which includes lectures, demonstrations including hands on with microscope preserved slides, practice sessions, case studies, projects, laboratory exercises, clinical experiences, Internet exercises, quizzes, exams, and recordings. All material covered by these methods maybe *covered* on Exams.

**Part 2: Phlebotomy**

1. **Learning Outcomes**: Upon successful completion of this lesson, the student will be able to:

   a. Describe the various types of specimens tested in the clinical laboratory and the importance of proper collection and handling
   b. Identify, evaluate, and select appropriate equipment and supplies to be used for skin puncture and venipuncture
   c. Identify the veins and their structure and determine appropriate venipuncture site.
   d. Demonstrate the proper use of a tourniquet for venipuncture
   e. Utilize proper safety procedures when performing phlebotomy
   f. Know stopper color coding and evaluate the use of various anticoagulants
   g. List the various tests affected by hemolysis
   h. Demonstrate the proper procedure used in the collection of capillary and venous specimens
   i. Utilize appropriate safety equipment and demonstrate proper disposal of collection equipment and blood specimens
   j. Evaluate specimens, and determine the integrity and appropriateness for acceptability for specific tests required
   k. Describe and demonstrate proper documentation of procedures and quality assurance related to phlebotomy
   l. Determine correct order of draw for venipuncture and capillary collections.
   m. Confirm patient identification for both phlebotomy draws and laboratory specimens.
   n. Recommend appropriate PPE for laboratory collection and specimen processing.
   o. At the conclusion of this lecture series, the student will have achieved the following: Achievement will be met when a minimum score of 75 percent is earned on the written examination covering the material.

2. **Learning Activities**: Methods of Teaching and Learning
   Students will be taught using various learning methods and activities which includes lectures, demonstrations including hands on with
microscope preserved slides, practice sessions, case studies, projects, laboratory exercises, clinical experiences, Internet exercises, quizzes, exams, and recordings. All material covered by these methods maybe covered on Exams.

**LECTURE TEST 1**

**B. Unit Two Part 1: Hematology**

1. **Learning Outcomes:** Upon successful completion of this lesson, the student will be able to:
   
   a. Discuss the origin of blood cells
   b. Explain the differences among veins, arteries, and capillaries
   c. Confirm the process of hemoglobin production
   d. Define hemopoiesis and hemostasis
   e. Name the 3 types of formed elements of blood and their function
   f. Name and identify red blood cells and white blood cells and their function
   g. Name and explain the function, and reference values for the 8 tests in a CBC (complete blood count)
   h. Explain red cell morphology and the terms used to describe
   i. Explain safety precautions that must be observed in the Hematology lab
   j. Explain the principle of the Hemocrit test and the Hemoglobin test
   k. Centrifuge and determine a Hemocrit sample
   l. Prepare a stain and a peripheral blood smear

2. **Learning Activities:** Methods of Teaching and Learning
   Students will be taught using various learning methods and activities which includes lectures, demonstrations including hands on with microscope preserved slides, practice sessions, case studies, projects, laboratory exercises, clinical experiences, Internet exercises, quizzes, exams, and recordings. All material covered by these methods maybe covered on Exams.

**LABORATORY EXAM 1**

**Unit Two: Part 2: Immunology, Serology, Immunohematology, Clinical Chemistry**

1. **Learning Outcomes:** Upon successful completion of this lesson, the student will be able to:
   
   a. Explain the mechanisms of humoral and cell-mediated immunity
   b. Identify various methods used in serology and detect diseases
c. Recognize the basic concepts of the immune process

d. List the various types of antigen-antibody reactions

e. Describe, perform, and evaluate the basic principles of the following: agglutination, precipitation, direct immunofluorescence, indirect immunofluorescence, latex agglutination, and relate to disease process

f. Determine acceptability of results. Correlate values with given disease states, diagnosis, and treatment

g. Name the 4 ABO & Rh blood groups and their frequency in the US.

h. Define Universal Donor. Explain what type is used when there is no time for crossmatch.

i. Explain the inheritance of blood groups

j. Name the blood group antigens and antibodies in the ABO system

k. Explain and perform a forward and reverse grouping

l. Explain the use of gel typing in the blood bank

m. List 6 body fluids tested in chemistry, explain tests, and the importance of proper collection and handling

n. Correlate lab testing with disease states

o. Explain Beer’s law and the principles of photometry

p. Identify frequently performed clinical chemistry tests, their normal or reference values, and explain the significance of each

q. Explain how reference values are established and used

r. Describe three technologies used in chemistry analyzers

s. Explain the importance of observing all safety precautions when using instrumentation

 t. Analyze an unknown using a spectrophotometer

u. Define pH, pH scale, solute, solvent, diluent, density, sensitivity, specificity, solution, vapor, crystals, accuracy and precision.

v. Discuss the importance of using controls and following quality assessment policies in immunology, Immunohematology and chemistry.

2. Learning Activities: Methods of Teaching and Learning

Students will be taught using various learning methods and activities which includes lectures, demonstrations including hands on with microscope preserved slides, practice sessions, case studies, projects, laboratory exercises, clinical experiences, Internet exercises, quizzes, exams, and recordings. All material covered by these methods maybe covered on Exams.

LECTURE EXAM 2

LABORATORY EXAM 2

C. Unit Three: Kidneys and Urinalysis
1. **Learning Outcomes:** Upon successful completion of this lesson, the student will be able to:

   a. Diagram and state the function of the kidney, glomerulus, and nephron
   b. Describe the basic physiology of the renal system
   c. Instruct patients/health care providers in the proper procedure for the collection of urine specimens
   d. Differentiate urine specimen types
   e. Evaluate acceptability of urine specimens
   f. Determine if collection technique and specimen container is appropriate
   g. Describe the factors that affect urine volume
   h. Store specimens appropriately for testing
   i. Explain the importance of using quality control
   j. Perform and evaluate QC results. Identify and take corrective action when QC is not within predetermined limits
   k. Prepare microscopic examination of urine specimens
   l. Utilize physical and chemical means to evaluate a normal/or an abnormal urinalysis:
      1. Observe and record color, clarity, odor, and volume
      2. Perform and record qualitative/semi-quantitative reagent strip chemical tests
      3. Evaluate and correlate the results of macroscopic and microscopic urinalysis. Correlate values with given disease states, diagnosis, and treatment
   m. Identify normal and abnormal cellular and formed elements in urine specimens. Identify crystals and indicate the pH at which they occur.
   n. Evaluate specimens and determine integrity and appropriateness for specific tests required. Predict physical changes that occur when a specimen is incorrectly stored.
   o. Explain the principle of each urine chemical test routinely performed by reagent strip method
   p. At the conclusion of this lecture series, the student will have achieved the following: Achievement will be met when a minimum score of 75 percent is earned on the written examination covering the material.

2. **Learning Activities:** Methods of Teaching and Learning
   Students will be taught using various learning methods and activities which includes lectures, demonstrations including hands on with microscope preserved slides, practice sessions, case studies, projects, laboratory exercises, clinical experiences, Internet exercises, quizzes,
exams, and recordings. All material covered by these methods maybe covered on Exams.

LECTURE EXAM 3—Anatomy and Physiology of Kidney, Physical Exam of Urine

LECTURE EXAM 4—Chemical and Microscopic Exam of Urine

D. Unit Four: Microbiology

1. **Learning Outcomes:** Upon successful completion of this lesson, the student will be able to:
   a. Know individuals responsible for classification of organisms
   b. Examine types of specimens received in the microbiology laboratory to determine acceptability.
   c. Utilize proper safety procedures and equipment in the microbiology laboratory
   d. Differentiate proper sterilization, disinfection, and aseptic techniques
   e. Compare and contrast media and its characteristics used in initial inoculation of specimens
   f. Demonstrate the correct procedure used in inoculating plate media
   g. Describe the proper techniques used in the disposal of material after smears and initial inoculations have been made
   h. Describe the gram stain principle used in the identification of bacteria.
   i. Perform the procedure for a gram stain. Record and interpret the results.
   j. Define and utilize taxonomy to classify organisms
   k. List the purpose of utilizing taxonomy in bacterial classification
   l. Define and know morphological classification of relevant human pathogens
   m. Define physiological classification with regard to staining characteristics and biochemical reactions
   n. Describe the proper technique for a gram stain
   o. List the factors affecting bacterial growth with regard to nutrition and environment
   p. List the cultural characteristics of various bacteria
   q. Identify gram negative and gram positive cocci, bacilli, and coccobacillary terms on a gram stain and prepared smears. Correlate values with given disease states, diagnosis, and treatment
   r. Perform and list the importance of quality control when performing microbiology procedures. Evaluate results of quality control.
   s. Discuss methods used to identify bacteria
t. Utilize physical and chemical means to evaluate abnormal flora
u. Explain the need for sensitivity testing of bacteria
v. Discuss and define normal flora.
w. Perform a colony count.
x. Demonstrate the procedure for collecting a throat swab and performing a throat culture. Identify Streptococcus pyogenes using a Bacitracin disk.
y. At the conclusion of this lecture series, the student will have achieved the following: Achievement will be met when a minimum score of 75 percent is earned on the written examination covering the material.

2. **Learning Activities**: Methods of Teaching and Learning

   Students will be taught using various learning methods and activities which includes lectures, demonstrations including hands on with microscope preserved slides, practice sessions, case studies, projects, laboratory exercises, clinical experiences, Internet exercises, quizzes, exams, and recordings. All material covered by these methods maybe covered on Exams.

LABORATORY EXAM 3

LECTURE EXAM 5

MLAX 1201 INTRODUCTION TO CLINICAL LABORATORY STUDIES

MLAX 1211 Urinalysis

**POINT SYSTEM FOR LAB**

<table>
<thead>
<tr>
<th>Laboratory Exams</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam 1  Phlebotomy and Hematology</td>
<td>100</td>
</tr>
<tr>
<td>Exam 2  Serology and Chemistry</td>
<td>100</td>
</tr>
<tr>
<td>Exam 3  Urinalysis and Microbiology</td>
<td>100</td>
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<tr>
<td><strong>Total Examination Points</strong></td>
<td>300</td>
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</tbody>
</table>

**Laboratory Assessment Points**

| Lab 2  Microscope Quiz | 5   |
| Lab 3  Lab Math Quiz   | 5   |
| Lab 4  Phlebotomy Equipment Quiz | 10 |
| Lab 5  VP Evaluation by Instructor | 20 |
| Lab 6  ABO Evaluation   | 5   |
| Lab 7  IM and RF due    | 10  |
| Lab 9  UA Physical Exam  | 5   |
| Lab 10 Dipstick and Confirmatory Tests | 10 |
| Lab 12 Complete UAs      | 15  |
Lab 14  Formed Elements Quiz  10
Lab 15  Gram Stains Due  5
Total Lab Assessment Points  100

Total Laboratory Points for Semester  400
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<thead>
<tr>
<th>Test Description</th>
<th>Points Value</th>
<th>Points Earned</th>
<th>Point Subtotal</th>
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<tbody>
<tr>
<td>Lecture Exam 1—Introduction to Laboratory/PBT</td>
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<td></td>
</tr>
<tr>
<td>Lecture Exam 2—Hematology/Immunology/BB/Chemistry</td>
<td>100</td>
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<tr>
<td>Lecture Exam 3—Kidney, Physical UA</td>
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<tr>
<td>Lecture Exam 4—UA-Chemical/Microscopic</td>
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<td>Lab 5: Venipuncture Evaluation</td>
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<td>Lab 6: ABO Testing</td>
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<td>Lab 7: Immuno-IMono &amp; Rheumatoid Factor Evaluation</td>
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<td>Lab 9: UA Physical Exam</td>
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<td>Lab 10: UA Dipstick &amp; Confirmatory Tests Evaluation</td>
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<td>Lab 12: Complete Urinalysis</td>
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<td>Lab 14: Formed Elements Quiz</td>
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<td>Lab 15: Gram Stain</td>
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<td>1100 – 990</td>
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<td>659 - Below</td>
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Must obtain a minimum of 770 points to successfully pass the class and earn credit toward degree plan.