GRAYSON COUNTY COLLEGE

MLAB 1311

URINALYSIS AND BODY FLUIDS

SPRING 2017

GRAYSON COUNTY COLLEGE
MEDICAL LABORATORY TECHNOLOGY

MLAB 1311 URINALYSIS AND BODY FLUIDS

TEXTBOOKS:

Required:

1. Strasinger, S.K., Di Lorenzo and Schaub, M., Urinalysis and Body Fluids. 6th ed., F.A. Davis Co., 2014.

Recommended: Numerous additional texts covering this topic are available in the MLT library or from the Instructor.

COURSE DESCRIPTION:

MLAB 1311. Urinalysis and Body Fluids. (2-4-3). Two hours lecture. Four hours lab. Three hours credit. An introduction to urinalysis and body fluid analysis, including the anatomy and physiology of the kidney, and physical, chemical and microscopic examination of urine, cerebrospinal fluid, and other body fluids. Prerequisite: MLAB 1201. A grade of "C" or better is required for graduation. (RM)

*GOALS:

Upon completion of this course the graduate should be prepared to function as a member of the health care team with the following duties and/or responsibilities:

1. To describe the principles of tests performed on urine and other body fluids.
2. To perform routine laboratory tests on urine and other body fluids and verify their validity with a quality assurance program in accordance with established standards of service.
3. To describe the principles and application of instrumentation used in urinalysis.
4. To apply the problem solving approach to distinguish situations that necessitate independent action from those that require referral to a supervisor.
5. To display a professional attitude toward colleagues.
6. To prepare records and transmit results accurately.
7. Observe safety policies and procedures.
8. Participate in continuing education.
9. Project an image of professionalism in appearance and conduct at all times.

COURSE REQUIREMENTS/ATTENDANCE POLICY:

In order to achieve a passing grade, the following requirements must be met:

1. Satisfactory Campus Lab performance. (A grade of "P". Urinalysis is designated as Critical Criteria.)
2. An overall average grade of 70% or better must be achieved on the Urinalysis and Body Fluids Unit Exams.
3. Regular attendance for lecture and Campus Lab is required. Responsibility for work missed is placed upon the student. More than two (2) absences are considered to be excessive.
4. A grade of "C" or better is required for graduation.

LEARNING OBJECTIVES:

Chapter 1: Safety in the Clinical Laboratory

Upon completion of this chapter, the reader will be able to:

1. List the components of the chain of infection and the laboratory safety precautions that break the chain.
2. Differentiate among and state the precautions addressed by Universal Precautions, body substance isolation, and Standard Precautions.
3. State the specifics of the Occupational Exposure to Blood-Borne Pathogens Standard.
4. Describe the types of personal protective equipment that laboratory personnel wear, including when, how, and why each article is used.
5. Correctly perform routine handwashing.
6. Describe the acceptable methods for disposing of biological waste and sharp objects in the urinalysis laboratory.
7. Discuss the components and purpose of chemical hygiene plans and material safety data sheets.
8. State the components of the National Fire Protection Association hazardous material labeling system.
9. Describe precautions that laboratory personnel should take with regard to radioactive and electrical hazards.
10. Explain the RACE and PASS actions to be taken when a fire is discovered.
11. Differentiate among class A, B, C, and D fires with regard to material involved and methods of extinguishing each type.
12. Recognize standard hazard warning symbols.
13. Discuss the quality assessment procedures and documentation for quality control of specimens, methodology, reagents, control materials, instrumentation, equipment, and reporting of results in the urinalysis laboratory.
14. Define the preanalytical, analytical, and postanalytical components of quality assessment.

15. Distinguish between the components of internal quality control, external quality control, and proficiency testing.
16. List the elements required for quality assurance as regulated by the Clinical Laboratory Improvement Amendments (CLIA).
17. Describe the four levels of the CLIA complexity model and how they relate to urinalysis testing.
18. Discuss the importance of continuous quality improvement and total quality management, including the recommendations of the Joint Commission on Accreditation of Healthcare Organizations.
19. Discuss the prevention of medical errors and the definition of a sentinel event.

Chapter 2: Introduction to Urinalysis

Upon completion of this chapter, the reader will be able to:

1. List three major organic and three major inorganic chemical constituents of urine.
2. Describe a method for determining whether a questionable fluid is urine.
3. Recognize normal and abnormal daily urine volumes.
4. Describe the characteristics of the recommended urine specimen containers.
5. Describe the correct methodology for labeling urine specimens.
6. State four possible reasons why a laboratory would reject a urine specimen.
7. List 10 changes that may take place in a urine specimen that remains at room temperature for more than 2 hours.
8. Discuss the actions of bacteria on an unpreserved urine specimen.
9. Briefly discuss five methods for preserving urine specimens, including their advantages and disadvantages.
10. Instruct a patient in the correct procedure for collecting a timed urine specimen and a mid-stream clean-catch specimen.
11. Describe the type of specimen needed for optimal results when a specific urinalysis procedure is requested.

Chapter 3: Renal Function

Upon completion of this chapter, the reader will be able to:

1. Identify the components of the nephron, kidney, and excretory system.
2. Trace the flow of blood through the nephron and state the physiologic functions that occur.
3. Describe the process of glomerular ultrafiltration.
4. Discuss the functions and regulation of the renin-angiotensin-aldosterone system.
5. Differentiate between active and passive transport in relation to renal concentration.
6. Explain the function of antidiuretic hormone in the concentration of urine.
7. Describe the role of tubular secretion in maintaining acid-base balance.

8. Identify the laboratory procedures used to evaluate glomerular filtration, tubular reabsorption and secretion, and renal blood flow
9. Discuss the advantages and disadvantages in using urea, inulin, creatinine, beta$_2$ microglobulin, cystatin C, and radionucleotides to measure glomerular filtration.
10. Given hypothetic laboratory data, calculate a creatinine clearance and determine whether the result is normal.
11. Discuss the clinical significance of the creatinine clearance test.
12. Given hypothetic laboratory data, calculate an estimated glomerular filtration rate.
13. Define osmolarity and discuss its relationship to urine concentration.
14. Describe the basic principles of clinical osmometers.
15. Given hypothetic laboratory data, calculate a free-water clearance and interpret the result.
16. Given hypothetic laboratory data, calculate a PAH clearance and relate this result to renal blood flow.
17. Describe the relationship of urinary ammonia and titratable acidity to the production of an acidic urine.

Chapter 4: Physical Examination of Urine

Upon completion of this chapter, the reader will be able to:

1. List the common terminology used to report normal urine color.
2. Discuss the relationship of urochrome to normal urine color.
3. State how the presence of bilirubin in a specimen may be suspected.
4. Discuss the significance of cloudy red urine and clear red urine.
5. Name two pathologic causes of black or brown urine.
6. Discuss the significance of phenazopyridine in a specimen.
7. State the clinical significance of urine clarity.
8. List the common terminology used to report clarity.
9. Describe the appearance and discuss the significance of amorphous phosphates and amorphous urates in freshly voided urine.
10. List three pathologic and four nonpathologic causes of cloudy urine.
11. Define specific gravity, and tell why this measurement can be significant in the routine analysis.
12. Describe the principles of the urinometer, refractometer, and harmonic oscillation densitometry methods for determining specific gravity.
13. State two advantages of performing specific gravity by refractometer rather than by urinometer.
14. Given the concentration of glucose and protein in a specimen, calculate the correction needed to compensate for these high-molecular-weight substances in the refractometer specific gravity reading.
15. Name two nonpathogenic causes of abnormally high specific gravity readings using a refractometer.

16. State possible causes of abnormal urine odor.

Chapter 5: Chemical Examination of Urine

Upon completion of this chapter, the reader will be able to:

1. Describe the proper technique for performing reagent strip testing.
2. List four causes of premature deterioration of reagent strips, and tell how to avoid them.
3. List five quality-control procedures routinely performed with reagent strip testing.
4. List two reasons for measuring urinary pH, and discuss their clinical applications.
5. Discuss the principle of pH testing by reagent strip.
6. Differentiate between prerenal, renal, and postrenal proteinuria, and give clinical examples of each.
7. Explain the "protein error of indicators," and list any sources of interference that may occur with this method of protein testing.
8. Discuss the sulfosalicylic acid (SSA) test for urine protein, including interpretation and sources of interference.
9. Describe the unique solubility characteristics of Bence Jones protein, and tell how they can be used to perform a screening test for the presence of this protein.
10. Discuss microalbuminuria including significance, reagent strip tests, and their principles.
11. Explain why glucose that is normally reabsorbed in the proximal convoluted tubule may appear in the urine, and state the renal threshold levels for glucose.
12. Describe the principle of the glucose oxidase method of reagent strip testing for glucose, and name possible causes of interference with this method.
13. Describe the copper reduction method for detection of urinary reducing substances, and list possible causes of interference.
14. Interpret matching and nonmatching results between the glucose oxidase and the copper reduction tests for glucose.
15. Name the three "ketone bodies" appearing in urine and three causes of ketonuria.
16. Discuss the principle of the sodium nitroprusside reaction, including sensitivity and possible causes of interference.
17. Differentiate between hematuria, hemoglobinuria, and myoglobinuria with regard to the appearance of urine and serum and clinical significance.
18. Describe the chemical principle of the reagent strip method for blood testing, and list possible causes of interference.
19. Discuss methods used to differentiate between hemoglobinuria and myoglobinuria.
20. Outline the steps in the degradation of hemo-globin to bilirubin, urobilinogens, and finally urobilin.
21. Describe the relationship of urinary bilirubin and urobilinogen to the diagnosis of bile duct obstruction, liver disease, and hemolytic disoroders.

22. Discuss the principle of the reagent strip test for urinary bilirubin, including possible sources of error.
23. Discuss the advantages and disadvantages of performing an Ictotest for detection of urine bilirubin.
24. State two reasons for increased urine urobilinogen and one reason for a decreased urine urobilinogen.
25. Describe the Watson-Schwartz test used to differentiate among urobilinogen, porphobilinogen, Ehrlich reactive compounds, and the Hoesch screening test for porphobilinogen.
26. Discuss the principle of the nitrite-reagent-strip test for bacteriuria.
27. List five possible causes of a false-negative result in the reagent-strip test for nitrite.
28. State the principle of the reagent strip test for leukocytes.
29. Discuss the advantages and sources of error of the reagent strip test for leukocytes.
30. Explain the principle of the chemical test for specific gravity.
31. Compare reagent strip testing for urine specific gravity with urinometer and refractometer testing.
32. Correlate physical and chemical urinalysis results.

Chapter 6: Microscopic Examination of the Urine

Upon completion of this chapter, the reader will be able to:

1. List the physical and chemical parameters included in macroscopic urine screening, and state their significance.
2. Discuss the advantages of commercial systems over the glass-slide method for sediment examination.
3. Describe the recommended methods for standardizing specimen preparation and volume, centrifugation, sediment preparation, volume and examination, and reporting of results.
4. State the purpose of Sternheimer-Malbin, acetic acid, toluidine blue, Sudan III, Gram, Hansel, and Prussian blue stains in the examination of the urine sediment.
5. Identify specimens that should be referred for cytodiagnostic testing.
6. Describe the basic principles of bright-field, phase-contrast, polarizing, dark-field, fluorescence, and interference-contrast microscopy, and their relationship to sediment examination.
7. Differentiate between normal and abnormal sediment constituents.
8. Discuss the significance of red blood cells (RBCs) in the urinary sediment.
9. Discuss the significance of white blood cells (WBCs) in the urinary sediment.
10. Name, describe, and give the origin and significance of the three types of epithelial cells found in the urinary sediment.
11. Discuss the significance of oval fat bodies.
12. Describe the process of cast formation.

13. Describe and discuss the significance of hyaline, RBC, WBC, bacterial, epithelial cell, granular, waxy, fatty, and broad casts.
14. List and identify the normal crystals found in acidic urine.
15. List and identify the normal crystals found in alkaline urine.
16. Describe and state the significance of cystine, cholesterol, leucine, tyrosine, bilirubin, sulfonamide, radiographic dye, and ampicillin crystals.
17. Differentiate between actual sediment constituents and artifacts.
18. Correlate physical and chemical urinalysis results with microscopic observations and recognize discrepancies.

Chapter 7: Renal Disease

Upon completion of this chapter, the reader will be able to:

1. Differentiate among renal diseases of glomerular, tubular, interstitial, and vascular origin.
2. Describe the processes by which immunologic damage is produced to the glomerular membrane.
3. Define glomerulonephritis.
4. Describe the characteristic clinical symptoms, etiology, and urinalysis findings in acute post-streptococcal and rapidly progressive glomerulonephritis, Goodpasture syndrome, Wegener's granulomatosis, and Henoch-Schonlein purpura.
5. Name a significant urinary sediment constituent associated with all of the aforementioned disorders.
6. Name three renal disorders that also involve acute respiratory symptoms.
7. Differentiate between membranous and membranoproliferative glomerulonephritis
8. Discuss the clinical course and significant laboratory results associated with immunoglobulin A nephropathy.
9. Relate laboratory results associated with the nephrotic syndrome to the disease process.
10. Compare and contrast the nephrotic syndrome and minimal change disease with regard to laboratory results and course of disease.
11. State two causes of acute tubular necrosis.
12. Name the urinary sediment constituent most diagnostic of renal tubular damage.
13. Describe Fanconi syndrome, Alport syndrome, and renal glucosuria.
14. Differentiate between diabetic nepluopathy and nephrogenic diabetes insipidus.
15. Compare and contrast the urinalysis results in patients with cystitis, pyelonephritis, and acute interstitial nephritis.
16. Differentiate among causes of laboratory results associated with prerenal, renal, and postrenal acute renal failure.
17. Discuss the formation of renal calculi, composition of. renal calculi, and patient management techniques.

Chapter 8: Urine Screening for Metabolic Disorders

Upon completion of this chapter, the reader will be able to:

1. Explain the abnormal accumulation of metabolites in the urine in terms of overflow and renal disorders.
2. Discuss the importance and procedures for newborn screening.
3. Name the metabolic defect in phenylketonuria, and describe the clinical manifestations it produces.
4. Discuss the performance of the tandem mass spectrophotometry and ferric chloride tests and their roles in the detection and management of phenylketonuria.
5. State three causes of tyros\ luria and the screening tests for its presence.
6. Name the abnormal urinary substance present in alkaptonuria, and tell how its presence may be suspected.
7. Discuss the appearance and significance of urine that contains melanin.
8. Describe a basic laboratory observation that has relevance in maple syrup urine disease.
9. Discuss the significance of ketonuria in a newborn.
10. Differentiate between the presence of urinary indican owing to intestinal disorders and Hartnup disease.
11. State the significance of increased urinary 5-hydroxyindoleacetic acid.
12. Differentiate between cystinuria and cystinosis, including the differences that are found during analysis of the urine and the disease processes.
13. Name the chemical screening test for cystine.
14. Describe the components in the heme synthesis pathway, including the primary specimens used for their analysis.
15. Briefly discuss the major porphyrias with regard to cause and clinical significance.
16. Differentiate between the Ehrlich reaction and fluorescent testing with regard to the testing of porphyrin components.
17. Describe the appearance of urine that contains increased porphyrins.
18. Define mucopolysaccharides, and name three syndromes in which they are involved.
19. List three screening tests for the detection of urinary mucopolysaccharides.
20. State the significance of increased uric acid crystals in newborns' urine.
21. Explain the reason for performing tests for urinary-reducing substances on all newborns.

Chapter 9: Cerebrospinal Fluid (CSF)

Upon completion of this chapter, the reader will be able to:

1. State the three major functions of cerebrospinal fluid (CSF).
2. Distribute CSF specimen tubes numbered 1, 2, and 3 to their appropriate laboratory sections and correctly preserve them.
3. Describe the appearance of normal CSF

4. Define xanthochromia and state its significance.
5. Differentiate between CSF specimens caused by intracranial hemorrhage and a traumatic tap.
6. Calculate CSF total, white blood cell (WBC), and red blood cell (RBC) counts when given the number of cells seen, amount of specimen dilution, and the squares counted in the Neubauer chamber.
7. Briefly explain the methods used to correct for WBCs and protein that are artificially introduced during a traumatic tap.
8. Describe the leukocyte content of the CSF in bacterial, viral, tubercular, and fungal meningitis.
9. Describe and give the significance of macrophages in the CSF
10. Differentiate between the appearance of normal choroidal cells and malignant cells.
11. State the normal value for CSF total protein.
12. List three pathologic conditions that produce an elevated CSF protein.
13. Determine whether increased CSF immunoglobulin is the result of damage to the blood-brain barrier or central nervous system production.
14. Discuss the significance of CSF electrophoresis findings in multiple sclerosis and the identification of CSF.
15. State the normal CSF glucose value.
16. Name the possible pathologic significance of a decreased CSF glucose.
17. Briefly discuss the diagnostic value of CSF lactate and glutamine determinations.
18. Name the microorganism associated with a positive India ink preparation.
19. Briefly discuss the diagnostic value of the bacterial and cryptococcal antigen tests.
20. Determine whether a suspected case of meningitis is most probably of bacterial, viral, fungal, or tubercular origin, when presented with pertinent laboratory data.
21. Describe the role of the Venereal Disease Research Laboratories test and fluorescent treponemal antibody-absorption test for syphilis in CSF testing.
22. Describe quality control procedures and safety precautions related to CSF procedures.

Chapter 10: Semen

Upon completion of this chapter, the reader will be able to:

1. State the structures involved in sperm production and their function.
2. Describe the four components of semen with 10 regard to source and function.
3. Describe the normal appearance of semen and three abnormalities in appearance.
4. State two possible causes of low semen volume.
5. Discuss the significance of semen liquefaction and viscosity.
6. Calculate a sperm concentration and count when provided with the number of sperm counted, the dilution, the area of the counting chamber used, and the ejaculate volume.
7. Define round cells, and explain their significance.

8. State the two parameters considered when evaluating sperm motility.
9. Differentiate between routine and strict criteria for evaluation of sperm morphology.
10. Given an abnormal result in the routine semen analysis, determine additional tests that might be performed.
11. Describe the two routinely used methods for detection of antisperm antibodies.
12. List two methods for identifying a questionable fluid as semen.
13. State the World Health Organization normal values for routine and follow-up semen analysis.
14. Discuss the types and significance of sperm function tests.
15. Describe the appearance of normal sperm, including structures and their functions.
16. Describe methods of quality control appropriate for the semen analysis.

Chapter 11: Synovial Fluid

Upon completion of this chapter, the reader will be able to:

1. Describe the formation and function of synovial fluid.
2. Relate laboratory test results to the four common classifications of joint disorders.
3. State the five most diagnostic tests performed on synovial fluid.
4. Determine the appropriate collection tubes for requested laboratory tests on synovial fluid.
5. Describe the appearance of synovial fluid in normal and abnormal states.
6. Discuss the normal and abnormal cellular composition of synovial fluid.
7. List and describe six crystals found in synovial fluid.
8. Explain the differentiation of monosodium urate and calcium pyrophosphate crystals using polarized and compensated polarized light.
9. State the clinical significance of glucose and lactate tests on synovial fluid.
10. List four genera of bacteria most frequently found in synovial fluid.
11. Describe the relationship of serologic testing of serum to joint disorders.

Chapter 12: Serous Fluid

Upon completion of this chapter, the reader will be able to:

1. Describe the normal formation of serous fluid.
2. Describe four primary causes of serous effusions.
3. Differentiate between a transudate and an exudate, including etiology, appearance, and laboratory tests.
4. Differentiate between a hemothorax and a hemorrhagic exudate.
5. Differentiate between a chylous and a pseudochylous exudate.
6. State the significance of increased neutrophils, lymphocytes, eosinophils, and plasma cells in pleural fluid.
7. Describe the morphologic characteristics of mesothelial cells and malignant cells.

8. List three common chemistry tests performed on pleural fluid, and state their significance.
9. State the common etiologies of pericardial effusions.
10. Discuss the diagnostic significance of peritoneal lavage.
11. Calculate a serum-ascites gradient, and state its significance.
12. Differentiate between ascitic effusions of hepatic and peritoneal origin.
13. State the clinical significance of the carcinoembryonic antigen and CA 125 tests.
14. List four chemical tests performed on ascitic fluid, and state their significance.

Chapter 13: Amniotic Fluid

Upon completion of this chapter, the reader will be able to:

1. State the functions of amniotic fluid.
2. Describe the formation and composition of amniotic fluid.
3. State indications for performing an amniocentesis.
4. Describe the specimen-handling and processing procedures for testing amniotic fluid for bilirubin, fetal lung maturity (FLM), and cytogenetic analysis.
5. Discuss the principle of the spectrophotometric analysis for evaluation of hemolytic disease of the newborn.
6. Interpret a Liley graph.
7. Describe the analysis of amniotic fluid for the detection of neural tube disorders.
8. Explain the physiologic significance of the lecithin-sphingomyelin (US) ratio.
9. State the relationship of phosphatidyl glycerol to FLM.
10. Discuss the principle of and sources of error for the US ratio, Amniostat-FLM, Foam Stability Index, and microviscosity tests for FLM.
11. Describe the relationship of lamellar bodies to FLM and the laboratory tests performed.

Chapter 14: Fecal Analysis

Upon completion of this chapter, the reader will be able to:

1. Describe the normal composition of feces.
2. Differentiate between secretory and osmotic diarrhea.
3. List three causes of diarrhea and steatorrhea.
4. Differentiate malabsorption from maldigestion syndromes and name a test that distinguishes the two conditions.
5. Instruct patients in the collection of random and quantitative stool specimens.
6. State a pathogenic and a nonpathogenic cause for stools that are red, black, and pale yellow.
7. State the significance of bulky, ribbon-like, and mucus-containing stools.
8. State the significance of increased neutrophils in a stool specimen.
9. Describe a positive microscopic examination for muscle fibers.
10. Name the fecal fats stained by Sudan III, and give the conditions under which they will stain.

11. Describe and interpret the microscopic results that are seen when a specimen from a patient with steatorrhea is stained with Sudan III.
12. Explain the principle of the guaiac test for occult blood and the reasons that guaiac is the reagent of choice.
13. Instruct a patient in the collection of specimens for occult blood, including providing an explanation of dietary restrictions.
14. Briefly describe a chemical screening test performed on feces for each of the following: fetal hemoglobin, pancreatic insufficiency, and carbohydrate intolerance.

Chapter 15: Vaginal Secretions

Upon completion of this chapter, the reader will be able to:

1. State the indications for collecting vaginal specimens.
2. Describe the specimen collection and handling procedures for vaginal specimens and explain how deviations from the correct practice will affect lest results.
3. Describe the appearance of normal and abnormal vaginal secretions.
4. Explain the significance of vaginal pH values.
5. List the diagnostic tests performed on vaginal secretions and explain the appropriate use for each.
6. Describe the microscopic constituents for the common syndromes associated with vaginitis.
7. Identify the most common causes of vaginitis including the cause, clinical signs and symptoms, laboratory tests, and treatment.
8. Describe two tests that can be performed on vaginal secretions to predict conditions of premature delivery and rupture of fetal membranes.Describe the normal composition of feces.
9. Differentiate between secretory and osmotic diarrhea.

INTEGRATION OF SCANS COMPETENCIES:

* Indicates Course Goals, Objectives, and/or Activities designed to achieve SCANS Competencies.

INTEGRATION OF SCANS COMPETENCIES
WITH COURSE GOALS, OBJECTIVES, AND ACTIVITIES

COURSE NUMBER MLAB 1311
COURSE NAME Urinalysis and Body Fluids

SCANS COMPETENCIES AND FOUNDATION SKILLS	COURSE GOALS, OBJECTIVES, AND ACTIVITIES
RESOURCES	
ALLOCATES TIME	Performs routine laboratory tests
ALLOCATES MONEY	
ALLOCATES MATERIAL AND FACILITY RESOURCES	Performs routine laboratory tests
ALLOCATES HUMAN RESOURCES	
INFORMATION	
ACQUIRES & EVALUATES INFORMATION	Prepares records Distinguishes situations that necessitate independent action from those that require referral to a supervisor
ORGANIZES & MAINTAINS INFORMATION	Prepares records
INTERPRETS & COMMUNICATES INFORMATION	Prepares and transmits records
USES COMPUTERS TO PROCESS INFORMATION	Completes tutorials on topics included in course Studies review questions on related topics
INTERPERSONAL	
PARTICIPATES AS A MEMBER OF A TEAM	Displays a professional attitude Cooperates with instructor and other students to maintain campus lab
TEACHES OTHERS	Presents case studies on related topics
SERVES CLIENTS/CUSTOMERS	
EXERCISES LEADERSHIP	Participates in class activities
NEGOTIATES TO ARRIVE AT DECISION	Participates in class activities
WORKS WITH CULTURAL DIVERSITY	Displays a professional attitude
SYSTEMS	

UNDERSTANDS SYSTEMS	Describes principles and application of instrumentation used in the laboratory Explains importance of quality assurance in the laboratory Practices Universal Precautions States reasons for performing a routine urinalysis
MONITORS & CORRECTS PERFORMANCE	Obtains results within limits set
IMPROVES & DESIGNS SYSTEMS	Demonstrates increasing dexterity, accuracy and speed
TECHNOLOGY	
SELECTS TECHNOLOGY	Chooses equipment and supplies needed to perform task
APPLIES TECHNOLOGY TO TASK	Uses equipment and supplies to perform test Establishes standard curves
MAINTAINS & TROUBLESHOOTS TECHNOLOGY	Keeps equipment clean and in good working order
BASIC SKILLS	
READING	Follows written instructions
WRITING	Prepares reports
ARITHMETIC	Does simple problems
MATHEMATICS	Becomes proficient in the use of mathematical manipulations used in the clinical laboratory to include basic mathematics, conversion factors, dilutions, solutions, logarithms, graphs, and specific calculations for selected tests.
LISTENING	Follows verbal instructions
SPEAKING	Communicates with others
THINKING SKILLS	
CREATIVE THINKING	
DECISION MAKING	Distinguishes situations that necessitate independent action from those that require referral to a supervisor
PROBLEM SOLVING	Applies problem solving approach to make decisions

	Practices problem solving in all areas of laboratory math
SEEING THINGS IN THE MIND'S EYE	Solves mathematical problems Observes urine sediment Acquires knowledge of instrumentation used in the laboratory
KNOWING HOW TO LEARN	Becomes proficient in laboratory mathematics Follows written and verbal instructions
REASONING	Evaluates procedures
PERSONAL QUALITIES	
RESPONSIBILITY	Arrives for class on time Follows safety rules and regulations Completes assignments
SELF-ESTEEM	Displays professional attitude
SOCIABILITY	Communicates with instructor and other students
SELF-MANAGEMENT	Prepares records Displays professional attitude
INTEGRITY/HONESTY	Displays professional attitude Records results exactly as determined

METHODS AND PROCEDURES OF INSTRUCTION:

Lecture/discussion and laboratory sessions will be correlated so that the six (6) hours per week will be utilized to the best advantage. Visual aids will be used to reinforce the presented material. CAI software is available for some topics. Campus laboratory experience, demonstration, textbooks, periodicals, and workshops (when available) will be utilized.

The student may be required to do some independent research.

EVALUATION OF STUDENT ACHIEVEMENT OF OBJECTIVES:

LECTURE: Written examinations will be given that cover the lecture material. Exams will be taken on Canvas in the Computer Lab on campus. A missed exam cannot be made up.

CAMPUS LAB: Evaluation of these objectives may be by practical or written examination. The Urinalysis Check-off has been designated as **CRITICAL CRITERIA**. This skill MUST be performed according to the standards prescribed in the objectives in order for the student to progress in the MLT program. The student will be allowed two (2) attempts to pass the check-off.

COURSE GRADE WILL BE DETERMINED BY THE FOLLOWING PROCESS:

Category	*Total*
Campus Labs	20%
UA Checkoff	10%
Assignments	5%
Study Questions	10%
Exams	35%
Final Exam	10%
Microscopic Slide Exam	5%
	Total = 100%

In order to pass the course, an average of 70% must be achieved on the Urinalysis and Body Fluids Unit Exams.

NUMERICAL VALUE OF GRADES:

A = 100.0% – 89.5%
B = < 89.5% – 79.5%
C = < 79.5% – 69.5%
D = < 69.5% – 59.5%
F = < 59.5% – 0.00%

COURSE PREPARATION AND POLICIES:

1. Prior to class, read each chapter as assigned.
2. Look up and learn any new terminology from the text to better understand the reading material.
3. Recording of either video and/or audio by students is not allowed in this course.
4. Questions during class time are always encouraged. However, all questions should be over topics relevant to the class, as determined by the instructor. For example, no questions concerning the validity of class/program policies are appropriate for classroom discussion. These may be addressed one-on-one with the instructor. Also, the instructor may request that specific questions should be handled one-on-one if they cause disruption to the learning process, for example questions that will slow the entire class's learning, or questions that may result in a confrontation between fellow students or between student(s) and the instructor.

DISABILITY STATEMENT:

Students with special needs should contact the Disability Services Coordinator in the Success Center no later than the first week of classes. Once appropriate documentation for the disability is received, the Disability Services Coordinator will coordinate delivery of approved accommodations with students and their instructors.

STATEMENTS REQUIRED BY THE COLLEGE:

Students are expected to maintain classroom decorum that includes respect for other students and the instructor, prompt and regular attendance and an attitude that seeks to take full advantage of the educational opportunity.

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Written by: A. Jackson
Revised: January 2017

COURSE OUTLINE

I. Safety in the Clinical Laboratory
   - A. Biological Hazards
   - B. Sharp Hazards
   - C. Chemical Hazards
   - D. Radioactive Hazards
   - E. Electrical Hazards
   - F. Fire/Explosive Hazards
   - G. Physical Hazards
   - H. Urinalysis Procedure Manual

II. Introduction to Urinalysis
   - A. History and Importance
   - B. Urine Formation
   - C. Urine Composition
   - D. Urine Volume
   - E. Specimen Collection
   - F. Specimen Handling
   - G. Types of Specimens

III. Renal Function
   - A. Renal Physiology
   - B. Renal Function Tests

IV. Physical Examination of Urine
   - A. Color
   - B. Clarity
   - C. Specific Gravity
   - D. Odor

V. Chemical Examination of Urine
   - A. Reagent Strips
   - B. pH
   - C. Protein
   - D. Prerenal Proteinuria
   - E. Renal Proteinuria
   - F. Postrenal Proteinuria
   - G. Reagent Strip Reactions
   - H. Glucose
   - I. Ketones
   - J. Blood
   - K. Bilirubin
   - L. Urobilinogen
   - M. Nitrite
   - N. Leukocyte Esterase
   - O. Specific Gravity

VI. Microscopic Examination of the Urine
   - A. Macroscopic Screening
   - B. Sedimentation Examination Techniques

- C. Urine Sediment Constituents

VII. Renal Diseases
- A. Glomerular Disorders
- B. Tubular Disorders
- C. Vascular Disorders
- D. Renal Failure
- E. Renal Lithiasis

VIII. Urine Screening for Metabolic Disorders
- A. Overflow versus Renal Disorders
- B. Newborn Screening Tests
- C. Amino Acid Disorders
- D. Porphyrin Disorders
- E. Mucopolysaccharide Disorders
- F. Purine Disorders
- G. Carbohydrate Disorders

IX. Cerebrospinal Fluid (CSF)
- A. Formation and Physiology
- B. Specimen Collection and Handling
- C. Appearance
- D. Traumatic Collection
- E. Cell Count
- F. Differential Count on CSF
- G. Chemistry Tests
- H. Microbiology Tests
- I. Serologic Tests

X. Semen
- A. Physiology
- B. Specimen Collection
- C. Semen Analysis
- D. Additional Testing

XI. Synovial Fluid
- A. Physiology
- B. Specimen Collection and Handling
- C. Color and Clarity
- D. Viscosity
- E. Cell Counts
- F. Differential Counts
- G. Crystal Identification
- H. Chemistry Tests
- I. Microbiologic Tests
- J. Serologic Tests

XII. Serous Fluid
- A. Formation
- B. Specimen Collection and Handling
- C. Transudates and Exudates
- D. General Laboratory Procedures

- E. Pleural Fluid
- F. Pericardial Fluid
- G. Peritoneal Fluid

XIII. Amniotic Fluid
- A. Physiology
- B. Specimen Collection and Handling
- C. Color and Appearance
- D. Tests for Fetal Distress
- E. Tests for Fetal Maturity

XIV. Fecal Analysis
- A. Physiology
- B. Diarrhea and Steatorrhea
- C. Specimen Collection
- D. Macroscopic Screening
- E. Microscopic Examination of Feces
- F. Chemical Testing of Feces

XV. Vaginal Secretions
- A. Specimen Collection and Handling
- B. Color and Appearance
- C. Diagnostic Tests
- D. Vaginal disorders
- E. Additional Vaginal Secretion Procedures

CAMPUS LAB

TPOs

Upon completion of the assignments and practice in Campus Lab the student should:

AFFECTIVE

1. Demonstrate a willingness to prepare for the role of MLT by

    a. arriving for campus lab sessions at the assigned time
    b. observing safety rules and regulations
    c. keeping records

        1) legibly recording results
        2) recording results exactly as determined
        3) keeping all class records current including checklists and progress reports

    d. cooperating with the instructor and fellow students to maintain the campus lab and equipment in good condition

PSYCHOMOTOR

2. Demonstrate the ability to perform laboratory tests by

    a. following written and verbal instructions
    b. demonstrating increasing dexterity in the performance of manual procedures
    c. demonstrating progressive accuracy, precision and speed
    d. obtaining results within the limits set for each test

COGNITIVE

3. Demonstrate a knowledge of theoretical concepts involved in the tests performed in campus lab by

    a. recognizing results which do not correlate and reporting them to the instructor

    b. associating unusual test results with the condition or disease which might be indicated

Specific Terminal Performance Objectives:

By completion of the phlebotomy class the student should be able to successfully perform a urinalysis, which includes the following objectives:

PHYSICAL EXAMINATION

1. Examine urines for correct color
2. Select a term for urine clarity appropriate for the sample
3. Demonstrate ability to correctly measure specific gravity

CHEMICAL EXAMINATION

1. Demonstrate ability to correctly interpret within 1 pad of accuracy the following parameters:
    a. Glucose
    b. Bilirubin
    c. Ketone
    d. Specific Gravity
    e. Blood
    f. pH
    g. Protein
    h. Urobilinogen
    i. Nitrite
    j. Leukocyte Esterase
2. Interpret results for each of the following confirmatory tests:
    a. Sulfosalicylic Acid
    b. Clinitest
    c. Acetest
    d. Ictotest

MICROSCOPIC EXAMINATION

1. Examine and identify the following formed elements:
    a. Casts
    b. Type
    c. Mucus
    d. Crystals (check on low also)
    e. Type
    f. WBCs
    g. RBCs
    h. Epithelial Cells
    i. Yeast
    j. Bacteria
    k. Other

INFECTION CONTROL PROCEDURES FOR GCC MLT-AD PROGRAM CAMPUS LAB

* **OBJECTIVE**: After a review of the following material and the Infection Control Procedures for Grayson County College MLT-AD Program Campus Lab, the student will practice established safety rules in Campus Lab.

Personal safety is of the utmost importance. Because many of the clinical specimens may contain highly pathogenic microorganisms, especially viruses, the laboratory can be a hazard to health unless certain rules of conduct are observed. Strict observance of safety rules is mandatory and will minimize exposure to blood-borne pathogens.

1. Hand-to-mouth exposure cannot be overemphasized. If hands are contaminated with blood or reagents, serious illness can be the result. The best rule to follow is never to allow the hands to come in contact with the mouth, face or eyes while conducting procedures.

    a. Smoking is strictly prohibited in the laboratory.

    b. Foods and beverages are not allowed in the laboratory area.

    c. Hands should be thoroughly washed with a disinfectant soap immediately after the completion of any laboratory work.

    d. Mouth pipetting is not allowed.

    e. Occasionally a container of blood or serum may be spilled or broken. Disinfectant procedures should be accomplished immediately and the incident reported to the instructor.

        1) Cover the spill with paper towels.

        2) Soak the paper towels with disinfectant and allow to stand for 20-30 minutes.

        3) Wipe up the spill and clean the area with disinfectant.

        4) If broken glass is involved, be care full not to cut your hands.

2. Face shields or safety shields may be used to avoid aerosols.

3. Protective clothing such as buttoned laboratory coats or aprons are essential. The items should be removed when leaving the laboratory for any reason. Gloves should be disposed of in biohazard bags after they have been used.

4. Contaminated materials and samples of blood should be placed in an appropriate container, autoclaved and then discarded.

5. Care of all work space and equipment and the maintenance of cleanliness is essential to avoid contaminating laboratory personnel. Bench spaces should be cleaned at the end of each lab session with a suitable disinfectant.

Proper laboratory conduct is really common sense, but its importance cannot be overemphasized. Many laboratory workers have become seriously infected because the few simple rules of good conduct in the laboratory have not been followed.

URINALYSIS
Report Form

Patient Name/Specimen No.: _____ **Date:** ___ / ____/ ___

PHYSICAL EXAMINATION		**Reference Range**
Color	_____	Light yellow to amber
Clarity	_____	Clear
Specific Gravity	_____	1.003 – 1.030

CHEMICAL EXAMINATION		**Reference Range**
Glucose	_____	Negative
Bilirubin	_____	Negative
Ketone	_____	Negative
Specific Gravity	_____	1.003 – 1.030
Blood	_____	Negative
pH	_____	5.5 – 8.0
Protein	_____	Negative, Trace
Urobilinogen	_____	0.1 – 1.0 E.U./dL
Nitrite	_____	Negative
Leukocyte Esterase	_____	Negative
Sulfosalicylic Acid	_____	
Clinitest	_____	
Acetest	_____	
Ictotest	_____	

MICROSCOPIC EXAMINATION			**Reference Range**
	_____		
Casts	_____	/LPF	Few
Type	_____		Hyaline
Mucus	_____	/LPF	Negative – Trace
Crystals (check on low also)	_____	/HPF	
Type	_____		
WBCs	_____	/HPF	0 – 3
RBCs	_____	/HPF	0 – 3
Epithelial Cells	_____	/HPF	Few
Yeast	_____	/HPF	Negative
Bacteria	_____	/HPF	Negative
Other	_____		

Student Name: _____ **Date:** ___ / ____/ ___