



URINALYSIS/BODY FLUIDS, MLAB 1211 -HYBRID

Course Syllabus: Spring 2024

NORTHEAST TEXAS
COMMUNITY COLLEGE

"Northeast Texas Community College exists to provide personal, dynamic learning experiences empowering students to succeed."

Instructor: Gaylon Barrett

Office: UHS 101

Phone: 903-434-8250

Email: gbarrett@ntcc.edu

Office Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Online
	Conference call or Zoom office meetings	12:30-4:00 In Office	8:30-11:30 12:30-4:00	By appt.	By appt.	anytime

This syllabus is an agreement between the instructor and the student.

Information relative to the delivery of the content contained in this syllabus is subject to change. Should that happen, the student will be notified by the instructor.

Course Description: 2 credit hours, This course is 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(s): Acceptance into MLT program

Student Learning Outcomes:

1. Apply principles of safety, quality assurance and quality control-Pre Analytical, analytical and Post-Analytical
2. Evaluate specimen acceptability
3. Explain principles of each test included in a routine urinalysis
4. Describe the composition, formation and function of selected body fluids
5. Explain the anatomy and functions of the renal system
6. Evaluate and correlate laboratory results with patient condition(s)
7. Demonstrate basic urinalysis and body fluid laboratory procedures

Evaluation/Grading Policy:

Exams 6 65% of total course

Laboratory 35% of total course
Lab procedures-10
Quizzes, homework

- A = 90% or above
- B = 80 - 89%
- C = 70 - 79%
- D = 60 - 69%
- F = less than 60%

A minimum grade of "C" is required for **BOTH** the lecture and laboratory components of all Medical Laboratory Technology courses. This means a 70 and above is required for both lecture exams and lab assignments. Failure to meet the minimum passing score in each area will result in a "D" for the course and possible dismissal from the program.

Tests/Exams:

Six scheduled exams will be given over lecture and laboratory material plus 2 unannounced quizzes will be given.

Required Instructional Materials:

Strasinger, Susan King and DiLorenzo, Marjorie: Urinalysis and Body Fluids, 7th Edition, 2021

Publisher: F. A. Davis

ISBN Number: 978-0-8036-7582-7

Optional Instructional Materials: None

Required Computer Literacy Skills:

SCANS Skills:

Resources - Identify supplies needed for each lab and organize laboratory procedure so that all supplies and equipment are used correctly.

Interpersonal - Recognize limitations of expertise and communicate with instructor when questions arise. Show respect for instructor and peers during class time.

Information - Apply information gained from lecture, laboratory and independent study to problem-solve results provided as case studies or unknowns during laboratory.

Systems - Apply critical thinking skills to problems encountered in the laboratory and theoretical case studies.

Technology - Achieve competency in routine urinalysis and body fluid procedures.

Course Structure and Overview:

This is a Hybrid class which means class meets once a week and all other instruction is done online via the learning management system BLACKBOARD. In class meetings will be reserved for lecture, case studies, labs and group projects. Students are expected to complete all the readings of the required e-book chapters, watch the instructional videos and complete the online chapter activities. You will see that the course is divided into 16 weeks in the Blackboard portion. Each week you will be expected to complete certain online homework assignments for the chapters found in that week's folder. This course requires daily computer and internet access. You should expect to spend no less than 3-6 hours a week in this course. Pay close attention to deadlines for all assignments. Assignments will not be accepted late! Technical difficulties are no excuse for late assignments. A due date assignment schedule is posted in the START HERE folder in Blackboard the entire semester! Please check it weekly so that you know what is due and do not miss anything.

Lectures & Discussions:

* Course objectives and schedule provided at the end of this syllabus
Safety and Quality Assessment, Pre-Analytical, Analytical, Post-Analytical
Introduction to urinalysis
Physical examination of urine
Chemical examination of urine
Urinalysis instrumentation
Microscopic examination of urine
Renal disease
Metabolic disorders
Cerebrospinal fluid Semen
Synovial fluid Serous fluids
Amniotic fluid Fecal analysis
Bronchoalveolar Lavage Fluid
Vaginal Secretions

Communications:

- **EMAIL:** Please check your NTCC email EVERYDAY. Email is the official form of communication used here at NTCC. All emailed questions to the instructor will be responded to within 8 hours, but usually within a few hours when possible. I will normally respond to you at least acknowledging that I received your inquiry and will answer as soon as possible.
- **TEXT MESSAGE NOTIFICATIONS:** Text messages will be accepted but only in an emergency basis or situation. Please use the office phone number or email first if all possible.
- **ANNOUNCEMENTS:** These can be found in Blackboard under the course link on your Bb homepage. Please make sure you are reading any announcements thoroughly when they are posted there.

Institutional/Course Policy:

Assignments:

All assignments are due on the specified due date. Assignments will not be accepted late unless there is a legitimate reason. Not coming to class is not a reason for not turning in assignments since they can be done electronically. No assignment will be accepted after graded assignments are returned.

Other Course Requirements:

Students are required to wear specified scrubs every day of class and laboratory. Appropriate laboratory attire is required - close-toed shoes, lab coat, and other supplied personal protective equipment if necessary. Without close-toed shoes or lab coat, no lab procedures may be performed and the grade will reflect a missed lab period.

Student Responsibilities/Expectations:

1. Attend all classes and labs, be on time and remain in class for the entire period. For every three days missed, one letter grade may be deducted from the final grade. Three episodes of tardiness or early departure will be equated with one class absence. Exams are to be taken on the scheduled date and time. Prior approval of the instructor is required for anyone missing an exam date. Makeup exams must be taken within 2 days of returning to campus. Every day after that will have 10 points deducted from the exam grade. Missing an exam without notifying the instructor will result in a grade of "0" for the exam. Anyone more than 15 minutes late for an exam without prior approval will take the exam in the testing center after the class period and have 10 points deducted from the exam grade.
2. Complete assigned readings before the lecture over each topic.

3. Be prepared to take notes and participate in class.
4. Be respectful of instructors and classmates.
5. All cell phones will be turned off or to silent during class time.
6. Laptops/tablets may be used for note-taking but do not abuse this privilege. They are not for personal use during class time.
7. Any missed laboratory session for any reason will require an essay of no less than 250 words (2 hand-written pages) covering the topic or activity performed during that session. This essay will be submitted before the next scheduled class period. The activity or procedure must also be made up, if possible, and any assignments as part of the missed lab session will also be turned in as soon as the lab activity has been completed. It is the student's responsibility to contact the instructor for such assignments.
8. When illness or emergencies arise which necessitate a student's absence from any scheduled class or other scheduled activity, the instructor should be notified as soon as possible.
9. There will be no makeup for unannounced quizzes.

NTCC Academic Honesty/Ethics Statement:

NTCC upholds the highest standards of academic integrity. The college expects all students to engage in their academic pursuits in an honest manner that is beyond reproach using their intellect and resources designated as allowable by the course instructor. Students are responsible for addressing questions about allowable resources with the course instructor. Academic dishonesty such as cheating, plagiarism, and collusion is unacceptable and may result in disciplinary action. This course will follow the NTCC Academic Honesty and Academic Ethics policies stated in the Student Handbook. Refer to the student handbook for more information on these subjects.

ADA Statement:

It is the policy of NTCC to provide reasonable accommodations for qualified individuals who are students with disabilities. This College will adhere to all applicable federal, state, and local laws, regulations, and guidelines with respect to providing reasonable accommodations as required to afford equal educational opportunity. It is the student's responsibility to request accommodations. An appointment can be made with the Academic Advisor/Coordinator of Special Populations located in Student Services and can be reached at 903-434-8264. For more information and to obtain a copy of the Request for Accommodations, please refer to the special populations page on the NTCC website.

Family Educational Rights and Privacy Act (FERPA):

The Family Educational Rights and Privacy Act (FERPA) is a federal law that protects the privacy of student education records. The law applies to all schools that receive funds under an applicable program of the U.S. Department of Education. FERPA gives parents certain rights with respect to their children's educational records. These rights transfer to the student when he or she attends a school beyond the high school level. Students to whom the rights have transferred are considered "eligible students." In essence, a parent has no legal right to obtain information concerning the child's college records without the written consent of the student. In compliance with FERPA, information classified as "directory information" may be released to the general public without the written consent of the student unless the student makes a request in writing. Directory information is defined as: the student's name, permanent address and/or local address, telephone listing, dates of attendance, most recent previous education institution attended, other information including major, field of study, degrees, awards received, and participation in officially recognized activities/sports.

Tentative Course Timeline (*note* instructor reserves the right to make adjustments to this timeline at any point in the term):

TENTATIVE Exam Schedule

Exam	Unit / Topics Covered	Date
1	Unit 1 – Chapters 1,3,4	Feb 1
2	Unit 2 – Chapters 5-7	Feb 22
3	Unit 3 – Chapters 8-9	Mar 21
4	Unit 4 – Chapters 10-13	Apr 4
5	Unit 5 – Chapters 14-17	Apr 25
Final Exam	Comprehensive FINAL Exam (Chapters 1,3-17)	May 9

TENTATIVE Lecture online topic / Laboratory Schedule

Date	Online Lecture Topic	Lab Activity	Assignment
Jan 18 (Week 1)	Course information / syllabus review / Chapter 1 – Safety and Quality Assessment	<i>Lab #1 - Safety</i>	Read Ch 1,3,4 Review Powerpoints HW Chapters 1,3,4
Jan 25 (Week 2)	Chapter 3 – Introduction to Urinalysis Chapter 4 – Renal Function Class discussions	QA / QC activities	Continue review HW chapters 1,3,4 due 1/25
Feb 1 (Week 3)	<i>EXAM 1 – CHAPTERS 1,3,4</i> Chapter 5 – Physical Exam of Urine	<i>Lab #2 – Physical exam of urine</i> <i>Lab #3 – Specific Gravity using the Refractometer</i>	Read Chapters 5-7 Review Powerpoints HW chapters 5-7
Feb 8 (Week 4)	Chapter 6 – Chemical Exam of Urine Chapter 7 – Microscopic Exam of Urine Class discussions	<i>Lab #4 – Urine reagent strips</i> <i>Lab #5 – Additional / confirmatory chemical tests</i>	Continue review and working on homework HW Chapters 5-7 due 2/15
Feb 15 (Week 5)	<i>Lab #6 – Microscopic examination of urine sediment</i> <i>Lab #7 – Complete UA</i> Practice of Labs 1 - 5		
Feb 22 (Week 6)	<i>EXAM 2 – CHAPTERS 5-7</i>	<i>Labs 1-7</i>	Read Chapters 8 and 9
Feb 29 (Week 7)	Chapter 8 – Renal Disease Chapter 9 – Metabolic Disorders Class discussions	<i>Lab practical</i> <i>Urinalysis</i>	Review Powerpoints
Mar 7 (Week 8)	Chapter 10 – Cerebrospinal Fluid Chapter 11 – Semen Analysis	<i>Lab #8 – body fluid cells counts</i>	Read Chapters 10-14 Review Powerpoints HW chapters 8-9 due 3/07
Mar 21 (Week 9)	<i>EXAM 3 – CHAPTERS 8-9</i> Chapter 12 – Synovial Fluid Class discussions	<i>Lab #8 – body fld cell cts</i> <i>Lab #9 – Semen analysis</i>	Continue review and working on homework

Mar 28 (Week 10)	Chapter 13 – Serous Fluids Class discussions	Lab #8 – body fluid cells counts	HW chapters 10-13 due 3/28
Apr 4 (Week 11)	EXAM 4 – CHAPTERS 10-13 Chapter 14- Bronchoalveolar Lavage Fluid Chapter 15 – Amniotic Fluid		Read Chapters 14-17 Review Powerpoints
Apr 11 (Week 12)	Chapter 16 – Fecal Analysis Chapter 17 – Vaginal Secretions	Lab #8 - BF CC Lab #10 – Fecal analysis	Continue review and working on homework
Apr 18 (Week 13)	Laboratory Activity practice and/or completion		HW chapters 14-17 due 4/18
Apr 25 (Week 14)	EXAM 5 CHAPTERS 14-17	Lab Practical Review	
May 2, (Week 15)	Final Review and Lab Practical		
May 9 (Week 16)	FINAL Comprehensive Exam Thursday 0930am (Chapters 1,3–17)		

Course Lecture Objectives:

UNIT 1 – Chapters 1,3,4

- List the six components of the chain of infection and the laboratory safety precautions that break the chain.
- State the purpose of the Standard Precautions policy and describe its guidelines.
- State the requirements mandated by the Occupational Exposure to Blood-Borne Pathogens Compliance Directive.
- Describe the types of personal protective equipment that laboratory personnel wear, including when, how, and why each article is used.
- Correctly perform hand hygiene procedures following CDC guidelines.
- Describe the acceptable methods for handling and disposing of biologic waste and sharp objects in the urinalysis laboratory.
- Discuss the components and purpose of chemical hygiene plans and MSD sheets.
- State and interpret the components of the National Fire Protection Association hazardous material labeling system.
- Explain the “RACE” and “PASS” actions to be taken when a fire is discovered.
- Recognize standard hazard warning symbols.
- Define the preexamination, examination, and postexamination components of quality assessment
- Distinguish between the components of internal quality control, external quality control, electronic quality control, and proficiency testing.
- List three major organic and three major inorganic chemical constituents of urine.
- Describe a method for determining whether a fluid is urine or not.
- Recognize normal and abnormal daily urine volumes.
- Describe the characteristics of the recommended urine specimen containers
- Describe the correct methodology for labeling urine specimens.
- State four possible reasons why a laboratory would reject a urine specimen.
- List 10 changes that may take place in a urine specimen that remains at room temperature for more than 2 hours.
- Discuss the actions of bacteria on an unpreserved urine specimen.
- Briefly discuss five methods for preserving urine specimens, including their advantages and disadvantages
- Instruct a patient in the correct procedure for collecting the following specimens: random, first morning, 24-hour timed, catheterized, midstream clean-catch, suprapubic aspiration, three-glass collection, and pediatric. Identify a diagnostic use for each collection technique.
- Describe the type of specimen needed for optimal results when a specific urinalysis procedure is requested.
- Identify the components of the nephron, kidney, and excretory system.
- Trace the flow of blood through the nephron and state the physiologic functions that occur.
- Discuss the functions and regulation of the renin-angiotensin-aldosterone system.
- Differentiate between active and passive transport in relation to renal concentration.
- Explain the function of ADH in urine concentration.
- Describe the role of tubular secretion in maintaining acid-base balance.
- Identify the laboratory procedures used to evaluate glomerular filtration, tubular reabsorption and secretion, and renal blood flow.
- Describe the creatinine clearance test.
- Given hypothetical laboratory data, calculate a creatinine clearance and determine whether the result is normal.

- Discuss the clinical significance of the glomerular filtration rate tests.
- Describe and contrast the MDRD, cystatin C, and beta₂-microglobulin tests for performing estimated glomerular filtration rates (eGFR).
- Define osmolarity and discuss its relationship to urine concentration.
- Describe the basic principles of freezing point osmometers.

UNIT 2 – Chapters 5-7

- List the common terminology used to report normal urine color.
- Discuss the relationship of urochrome to normal urine color.
- State how the presence of bilirubin, biliverdin, uroerythrin, and urobilin in a specimen may be suspected.
- Discuss the significance of cloudy red urine and clear red urine.
- Name two pathologic causes of black or brown urine.
- Discuss the significance of phenazopyridine in a specimen.
- State the clinical significance of urine clarity.
- List the common terminology used to report clarity.
- Describe the appearance and discuss the significance of amorphous phosphates and urates in freshly voided urines.
- List three pathologic and four nonpathologic causes of cloudy urine.
- Define specific gravity, and tell why this measurement can be significant in the routine urinalysis.
- Describe the principles of the refractometer, reagent strip, and osmolality for determining specific gravity.
- Name two nonpathogenic causes of abnormally high specific gravity readings using a refractometer.
- Describe the advantages of measuring specific gravity using a reagent strip and osmolality.
- State possible causes of abnormal urine odor.
- Describe the proper technique for performing reagent strip testing.
- List four causes of premature deterioration of reagent strips, and tell how to avoid them.
- List five quality-control procedures routinely performed with reagent strip testing.
- List the reasons for measuring urinary pH, and discuss their clinical applications.
- Differentiate between prerenal, renal, and postrenal proteinuria and give clinical examples of each.
- Explain the “protein error of indicators,” and list any sources of interference that may occur with this method of protein testing.
- Discuss microalbuminuria including significance, reagent strip tests, and their principles.
- 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.
- Explain the principle of the glucose oxidase method of reagent strip testing for glucose and name some possible causes of interference.
- Describe the copper reduction method for detecting reducing substances in urine, and discuss the current use of this procedure
- Name the three ketone bodies appearing in urine and three cause of ketonuria.
- Discuss the principle of the sodium nitroprusside reaction to detect ketones, including sensitivity and possible causes of interference.

- Differentiate between hematuria, hemoglobinuria, and myoglobinuria with regard to the appearance of urine and serum and clinical significance.
- Describe the chemical principle of the reagent strip method for blood testing, and list possible causes of interference.
- Outline the steps in the degradation of hemoglobin to bilirubin, urobilinogen, and finally urobilin
- Describe the relationship of urinary bilirubin and urobilinogen to the diagnosis of bile duct obstruction, liver disease, and hemolytic disorders.
- Discuss the principle of the reagent strip test for urinary bilirubin, including possible sources of error.
- State two reasons for an increased urine urobilinogen and one reason for a decreased urine urobilinogen.
- Discuss the principle of the nitrite-reagent-strip test for bacteriuria.
- List five possible causes of a false-negative result in the reagent strip test for nitrite.
- State the principle of the leukocyte esterase reagent strip test.
- Discuss the advantages of performing this test and some sources of error.
- Explain the principle of the chemical test for specific gravity.
- Compare reagent strip testing for Specific Gravity with osmolality and refractometer methods.
- Correlate physical and chemical urinalysis results.
- List the physical and chemical parameters included in macroscopic urine screening, and state their significance.
- Discuss the advantages of commercial systems over the glass-slide method for sediment examination.
- Describe the recommended methods for standardizing specimen preparation and volume, centrifugation, sediment preparation, volume, and examination, and reporting of results.
- Identify specimens that should be referred for cytodagnostic testing.
- Differentiate between normal and abnormal sediment constituents.
- Discuss the significance of
 - Red blood cells in the urinary sediment
 - White blood cells in the urinary sediment
 - Oval fat bodies
- Name, describe, and give the origin and significance of the three types of epithelial cells found in the urinary sediment.
- Describe the process of cast formation.
- Describe and discuss the significance of
 - Hyaline casts
 - RBC casts
 - WBC casts
 - Bacterial casts
 - Epithelial cell casts
 - Granular casts
 - Waxy casts
 - Fatty casts
 - Broad casts
- List and identify the normal crystals found in
 - Acidic urine
 - Alkaline urine

- Describe and state the significance of cystine, cholesterol, leucine, tyrosine, bilirubin, sulfonamide, radiographic dye, and ampicillin crystals.
- Differentiate between actual sediment constituents and artifacts.
- Correlate physical and chemical urinalysis results with microscopic observations and recognize discrepancies.

UNIT 3 – Chapters 8-9

- Differentiate among renal diseases of glomerular, tubular, interstitial, and vascular origin.
- Describe the processes by which immunologic damage is caused to the glomerular basement membrane.
- Define glomerulonephritis.
- Describe the characteristic clinical symptoms, etiology, and urinalysis findings in
 - Acute post-streptococcal glomerulonephritis
 - Rapidly progressive glomerulonephritis
 - Goodpasture syndrome
 - Wegener's granulomatosis
 - Henoch-Schonlein purpura
- Name three renal disorders that also involve acute respiratory symptoms.
- Discuss the clinical course and significant laboratory results associated with immunoglobulin A nephropathy.
- Relate laboratory results associated with the nephrotic syndrome to the disease process.
- Compare and contrast the nephritic syndrome and minimal change disease with regard to laboratory results and course of disease.
- State two causes of acute tubular necrosis.
- Name the urinary sediment constituent most diagnostic of renal tubular damage.
- Describe
 - Fanconi syndrome
 - Alport syndrome
 - Renal glucosuria
- Differentiate between diabetic nephropathy and nephrogenic diabetes insipidus.
- Compare and contrast the urinalysis results in patients with cystitis, pyelonephritis, and acute interstitial nephritis.
- Discuss the formation of renal calculi, composition of renal calculi, and patient management techniques.
- Differentiate among causes of laboratory results associated with prerenal, renal, and postrenal acute renal failure.
- Explain abnormal accumulation of metabolites in the urine in terms of overflow and renal disorders.
- Discuss the importance of and the MS/MS testing methods for newborn screening.
- Name the metabolic defect in phenylketonuria, and describe the clinical manifestations it produces.
- State three causes of tyrosyluria
- Name the abnormal urinary substance present in alkaptonuria, and tell how its presence may be suspected.
- Discuss the appearance and significance of urine that contains melanin.
- Describe a basic laboratory observation that has relevance in maple syrup urine disease.
- Discuss the significance of ketonuria in a newborn.

- Differentiate between the presence of urinary indican owing to intestinal disorders and Hartnup disease.
- Differentiate between cystinuria and cystinosis, including the differences found during analysis of the urine and the disease processes.
- State the significance of increased urinary 5-hydroxyindoleacetic acid.
- Describe the components in the heme synthesis pathway, including the primary specimens used for their analysis, and explain the cause and clinical significance of major porphyrias and the appearance of porphyrins in urine.
- Define mucopolysaccharides, and name three syndromes in which they are involved.
- State the significance of increased uric acid crystals in newborns' urine.
- Explain the reason for performing tests for urinary-reducing substances on all newborns.

UNIT 4 – Chapters 10-13

- State the 3 major functions of cerebrospinal fluid (CSF)
- Distribute CSF specimen tubes numbered 1, 2, 3, and possibly 4 to their appropriate laboratory sections and correctly preserve them.
- Describe the appearance of normal CSF and the causes of abnormally appearing CSF.
- Define xanthochromia and state its significance.
- Differentiate between CSF specimens caused by intracranial hemorrhage and a traumatic tap.
- Calculate CSF 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.
- Describe the leukocyte content of the CSF in bacterial, viral, tubular, and fungal meningitis.
- Describe and give the significance of macrophages in the CSF.
- State the reference values for CSF total protein and name 3 pathologic conditions that produce an elevated CSF protein.
- Determine whether increased CSF immunoglobulin is the result of damage to the blood-brain barrier or central nervous system production.
- Discuss the significance of CSF electrophoresis, immunophoresis, and isoelectric focusing findings in multiple sclerosis and the identification of CSF.
- State the reference values for CSF glucose and name the possible pathologic significance of a decreased CSF glucose.
- Briefly discuss the diagnostic value of CSF lactate and glutamine determinations.
- Name the microorganism associated with a positive India ink preparation.
- Briefly discuss the diagnostic value of the bacterial and cryptococcal antigen tests.
- Determine whether a suspected case of meningitis is most probably of bacterial, viral, fungal, or tubercular origin, when presented with pertinent laboratory data.
- Describe the role of the Venereal Disease Research Laboratories test and fluorescent treponemal antibody-absorption test for syphilis in CSF testing.
- Describe quality control procedures and safety precautions related to CSF procedures.
- State the structures involved in sperm production and their function.
- Describe the four components of semen with regard to source and function.
- Explain the procedures for collecting and handling semen specimens.
- Describe the normal appearance of semen and three abnormalities in appearance.
- State two possible causes of low semen volume.
- Discuss the significance of semen liquefaction and viscosity.
- 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.

- Define round cells; explain their significance.
- State the two parameters considered when evaluating sperm motility.
- Describe the appearance of normal sperm, including structures and their functions.
- Differentiate between routine and strict criteria for evaluating sperm morphology.
- List two methods for identifying a questionable fluid as semen.
- State the World Health Organization normal values for routine and follow-up semen analysis.
- Describe methods of quality control appropriate for semen analysis.
- Describe the formation and function of synovial fluid.
- Relate laboratory test results to the four common classifications of joint disorders.
- State the five most diagnostic tests performed on synovial fluid.
- Determine the appropriate collection tubes for requested laboratory tests on synovial fluid.
- Describe the appearance of synovial fluid in normal and abnormal states.
- Discuss the normal and abnormal cellular composition of synovial fluid.
- List and describe six crystals found in synovial fluid.
- Explain the differentiation of monosodium urate and calcium pyrophosphate crystals using polarized and compensated polarized light.
- State the clinical significance of glucose and lactate tests on synovial fluid.
- List four genera of bacteria most frequently found in synovial fluid.
- Describe the relationship of serologic serum testing to joint disorders.
- Describe the normal formation of serous fluid.
- Describe four primary causes of serous effusions.
- Differentiate between a transudate and an exudates, including etiology, appearance, and laboratory tests.
- Differentiate between a hemothorax and a hemorrhagic exudates.
- State the significance of increased neutrophils, lymphocytes, eosinophils, and plasma cells in pleural fluid.
- Describe the morphologic characteristics of mesothelial cells and malignant cells.
- List three common chemistry tests performed on pleural fluid, and state their significance.
- State the common etiologies of pericardial effusions.
- Discuss the diagnostic significance of peritoneal lavage.
- Differentiate between ascitic effusions of hepatic and peritoneal origin.
- State the clinical significance of the carcinoembryonic antigen and CA 125 tests.
- List four chemical tests performed on ascetic fluid, and state their significance.

UNIT 5 – Chapters 14-17

- State the functions of amniotic fluid.
- Describe the formation and composition of amniotic fluid.
- Differentiate maternal urine from amniotic fluid.
- State indications for performing an amniocentesis.
- Describe the specimen-handling and processing procedures for testing amniotic fluid for bilirubin, fetal lung maturity (FLM), and cytogenetic analysis.
- Discuss the principle of the spectrophotometric analysis for evaluation of hemolytic disease of the newborn.
- Describe the analysis of amniotic fluid for the detection of neural tube disorders.
- Explain the physiologic significance of the lecithin-sphingomyelin (L/S) ratio.
- State the relationship of phosphatidyl glycerol to FLM.

- Define lamellar bodies and describe their significance to FLM.
- Discuss the principle of and sources of error for the L/S ratio, Amniostat-FLM, lamellar body count, and Foam Stability Index for FLM.
- Describe the normal composition and formation of feces.
- Differentiate between secretory and osmotic diarrhea using fecal electrolytes, fecal osmolality, and stool pH.
- List three causes of secretory and osmotic diarrhea.
- Describe the mechanism of altered motility and at least three conditions that can cause it.
- List 3 causes of steatorrhea.
- Differentiate malabsorption from maldigestion syndromes and name a test that distinguishes the two conditions.
- Instruct patients in the collection of random and quantitative stool specimens.
- State a pathogenic and a nonpathogenic cause for stools that are red, black, and pale yellow.
- State the significance of bulky, ribbon-like, and mucus-containing stools.
- State the significance of increased neutrophils in a stool specimen.
- Name the fecal fats stained by Sudan III, and give the conditions under which they will stain.
- Describe and interpret the microscopic results that are seen when a specimen from a patient with steatorrhea is stained with Sudan III.
- Discuss the collection procedure for a quantitative fecal fat and methods for analysis.
- Explain the methods used to detect fecal occult blood.
- Instruct a patient in the collection of specimens for occult blood, including providing an explanation of dietary restrictions.
- Briefly describe a chemical screening test performed on feces for each of the following:
 - fetal hemoglobin
 - pancreatic insufficiency
 - carbohydrate intolerance
- State the indications for collecting vaginal specimens.
- Describe the specimen collection and handling procedures for vaginal specimens and explain how deviations from the correct practice will affect test results.
- Describe the appearance of normal and abnormal vaginal secretions.
- Explain the significance of vaginal pH values.
- List the diagnostic tests performed on vaginal secretions and explain the appropriate use for each.
- Describe the microscopic constituents for the common syndromes associated with vaginitis.
- Identify the most common causes of vaginitis including the cause, clinical signs and symptoms, laboratory tests, and treatment.
- Describe two tests that can be performed on vaginal secretions to predict conditions of premature delivery and rupture of fetal membranes.

Course Laboratory Objectives

Laboratory activity #1 – Lab Safety

Upon completion of this lab assignment, the student will be able to:

- List the components of the chain of infection and the laboratory safety precautions that break the chain
- Discuss the major features of Standard Precautions guidelines
- Describe the types of personal protective equipment that laboratory personnel use.
- Describe acceptable methods for disposing of biological waste and sharp objects.
- Discuss the components and purpose of chemical hygiene plans and material safety data sheets.
- State the components of the National Fire Protection Association hazardous material labeling system.
- Explain the RACE and PASS actions to be taken when a fire is discovered.
- Differentiate among class A, B, C, and D fires with regard to material involved and methods of extinguishing each type.
- Recognize standard hazard warning symbols.
- *Correctly perform routine handwashing.*

Laboratory activity #2 – Physical examination of urine

Upon completion of this lab assignment, the student will be able to:

- List the common terminology used to report normal urine color.
- Discuss the significance of cloudy red urine and clear red urine.
- Name at least two pathologic causes of black or brown urine.
- State the clinical significance of urine clarity.
- List the common terminology used to report clarity of urine.
- List at least three pathologic and four nonpathologic causes of cloudy urine.
- Describe the appearance and discuss the significance of amorphous phosphates and amorphous urates in freshly voided urine.
- *Perform a physical examination of 10 urine specimens*
 - *Observe and report urine color that agrees clinically with the instructor*
 - *Observe and report urine clarity that agrees clinically with the instructor*

Laboratory activity #3 – Urine Specific Gravity using Refractometer

Upon completion of this lab assignment, the student will be able to:

- Define specific gravity and tell why this measurement can be significant in the routine urinalysis
- Describe the principles of the refractometer method for determining specific gravity.
- Name two nonpathogenic causes of abnormally high specific gravity readings using a refractometer.
- *Successfully perform specific gravity measurements on 5 urine specimens using the refractometer*
 - *Result must agree within $\pm .005$ of instructor reading*
 - *Student must use appropriate equipment and specimen (PPE, dropper/pipette, properly collected, stored, and mixed specimen)*

Laboratory activity #4 – Chemical examination of urine, reagent strips

Upon completion of this lab assignment, the student will be able to:

- *Describe and demonstrate the proper technique for performing reagent strip testing (manual reading).*
 - *Use appropriate PPE and properly prepared specimen*
 - *Dip strip appropriately*
 - *Tap or drag along edge of container*
 - *Blot edge of strip on paper towel*
 - *Use required time limits for each analyte*
- *Describe and demonstrate the proper technique for performing reagent strip testing using the Clinitek Status analyzer (successfully perform strip reading of at least 5 quality control specimens). Results must agree with published QC ranges.*
- *Correlate physical and chemical urinalysis results*
- *Name the 10 urine chemical tests we test for and give the reference values for each.*
- *Successfully perform a chemical examination of 3 urine specimens using reagent strip manual reading.*
 - *Each test must agree with instructor within ± 1 pad*

Laboratory activity #5 – Additional or confirmatory chemical examination of urine

Upon completion of this lab assignment, the student will be able to:

- *Describe the Clinitest (copper reduction method) for detection of urinary reducing substances and list possible causes of interference*
- *Interpret matching and nonmatching results between the reagent strip (glucose oxidase) and the Clinitest results.*
- *Successfully perform the Clinitest method*
 - *Must agree within ± 1 color block on the color chart with instructor reading*
 - *Use appropriate technique*
 - *Use safety considerations of chemical reaction (point tube away from you)*
 - *Use appropriate equipment and specimen (PPE and appropriately diluted specimen).*
- *Discuss the advantages and disadvantages of performing an Ictotest for detection of urine bilirubin.*
- *Successfully perform the Ictotest method*
 - *Must agree with instructor reading (positive or negative)*
- *Discuss the need for the use of Acetest tablets*
- *Successfully perform the Acetest test*
 - *Must agree with instructor reading (positive or negative)*

Laboratory activity #6 – Microscopic examination of urine sediment

Upon completion of this lab assignment, the student will be able to:

- Describe the recommended methods for standardizing specimen preparation and volume, centrifugation, sediment preparation, volume and examination, and reporting of results.
- Differentiate between normal and abnormal sediment constituents.
- Identify RBCs, WBCs, epithelial cells, various types of casts (hyaline, RBC, WBC, bacterial, epithelial cell, granular, waxy, fatty, and broad), normal and abnormal crystals found in acidic and alkaline urine.
- Differentiate between actual sediment constituents and artifacts.
- Correlate physical and chemical urinalysis results with the microscopic observations and recognize discrepancies.
- *Prepare specimens for microscopic examination of urine sediment.*
- *Perform microscopic examinations of urine sediment (5 specimens) and report the results successfully (must agree clinically with instructor results).*

Laboratory activity #7 – Complete urinalysis

Upon completion of this lab assignment, the student will be able to:

- *Successfully perform a complete urinalysis (physical, chemical and microscopic exams) on 5 urine specimens using correct technique and equipment*
 - *Results must agree with instructor results as in previous lab sessions*
 - *Physical results must agree clinically with instructor results*
 - *Chemical results must agree within ± 1 pad with instructor results*
 - *Microscopic results must agree clinically with instructor results*

Laboratory activity #8 – Body fluid cell counts using hemacytometer

Upon completion of this lab assignment, the student will be able to:

- With regard to cerebrospinal fluid (CSF), distribute the specimen tubes to their appropriate laboratory sections and correctly preserve them.
- Describe the appearance of normal CSF.
- Define and recognize xanthochromia and state its significance
- Differentiate between CSF specimens caused by intracranial hemorrhage and a traumatic tap.
- Calculate CSF WBC and RBC counts when given the number of cells seen, amount of specimen dilution, and the squares counted in the Hemacytometer.
- Describe quality control procedures and safety precautions related to CSF procedures.
- *Successfully perform a cell count (WBC and/or RBC) on 5 body fluid specimens*
 - *Reported results must agree within 10% of instructor results.*

Laboratory activity #9 – Semen analysis (motility and counts)

Upon completion of this lab assignment, the student will be able to:

- Describe the normal appearance of semen and three abnormalities in appearance.
- Discuss the significance of semen liquefaction and viscosity.
- 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.
- State the two parameters considered when evaluating sperm motility.
- Describe the appearance of normal sperm, including structures and their function.
- Given an abnormal result in the routine semen analysis, determine additional tests that might be performed.
- List two methods for identifying a questionable fluid as semen.

- State the World Health Organization normal values for routine and follow-up semen analysis.
- Describe methods of quality control appropriate for the semen analysis.

Laboratory activity #10 – Fecal analysis

Upon completion of this lab assignment, the student will be able to:

- Explain the principle of the guaiac test for occult blood and the reasons that guaiac is the reagent of choice.
- Instruct a patient in the collection of specimens for occult blood, including providing an explanation of dietary restrictions.
- *Successfully perform fecal occult blood testing on 5 fecal specimens.*

Laboratory activity #11 – Vaginal secretions

Upon completion of this lab assignment, the student will be able to:

- Describe the specimen collection and handling procedures for vaginal specimens and explain how deviations from the correct practice will affect test results.
- Describe the appearance of normal and abnormal vaginal secretions.
- List the diagnostic tests performed on vaginal secretions and explain the appropriate use for each.
- *Successfully identify given microscopic constituents for the common syndromes associated with vaginitis.*