



MLAB 1211 - Urinalysis and Body Fluids MLAB1211.401 Course Syllabus

Description

An introduction to the study of urine and body fluid analysis. Includes the anatomy and physiology of the kidney, physical, chemical and microscopic examination of urine, cerebrospinal fluid and other body fluids as well as quality control, quality assurance and safety.

Semester Offered

Spring Only

Credits 2

Lecture Hours 1

Lab Hours 4

Extended Hours 0

Contact Hours 80

State Approval Code 5110040000

Instructor Name Kimberly Bishop, RHIT, MLT(AMT), RMA(AMT)

Semester/Year Spring 2025

Meeting Time and Location

Lab Dates: February 1st, March 8th, and April 12th.

Alternate Operations During Campus Closure

In the event of an emergency or announced campus closure due to a natural disaster or pandemic, it may be necessary for Panola College to move to altered operations. During this time, Panola College may opt to continue delivery of instruction through methods that include, but are not limited to: online learning management system (CANVAS), online conferencing, email messaging, and/or an alternate schedule. It is the responsibility of the student to monitor Panola College's website (www.panola.edu) for instructions about continuing courses remotely, CANVAS for each class for course-specific communication, and Panola College email for important general information.

Student Basic Needs

Unexpected circumstances may arise, but Panola College offers various resources to support students. If you need mental health services or are facing challenges with transportation, affording class materials and supplies, or accessing food regularly—issues that may impact your class performance—please visit panola.edu/resources.

Class Attendance

Regular and punctual attendance of classes and laboratories is required of all students. When a student has been ill or absent from class for approved extracurricular activities, he or she should be allowed, as far as possible, to make up for the missed work. If a student has not actively participated by the census date, they will be dropped by the instructor for non-attendance. This policy applies to courses that are in-person, online, hybrid, and hyflex.

Attendance in online courses is determined by submission of an assignment or participation in an activity. According to federal guidelines, simply logging into a distance learning course without participating in an

academic assignment does not constitute attendance. Distance learning is defined as when a majority (more than 50%) of instruction occurs when the instructor and students are in separate physical locations. Students must engage in an academic activity prior to the course census date.

When an instructor feels that a student has been absent to such a degree as to invalidate the learning experience, the instructor may recommend to the Vice President of Instruction that the student be withdrawn from the course. Instructors may seek to withdraw students for non-attendance after they have accumulated the following number of absences:

Fall or spring semesters:

3 or more class meeting times per week - 5 absences

2 class meeting times per week - 3 absences

1 class meeting per week - 2 absences

The student is responsible for seeing that he or she has been officially withdrawn from a class. A student who stops attendance in a class without officially withdrawing from that class will be given a failing grade; consequently, the student must follow official withdrawal procedures in the Admissions/Records Office.

Please note: Health Science and Cosmetology courses may require more stringent attendance policies based on their accreditation agencies. Please see the addendum and/or program handbook for further information concerning attendance.

Pregnant/Parenting Policy

Panola College welcomes pregnant and parenting students as a part of the student body. This institution is committed to providing support and adaptations for a successful educational experience for pregnant and parenting students. Students experiencing a need for accommodations related to pregnancy or parenting will find a Pregnancy and Parenting Accommodations Request form in the Student Handbook or may request the form from the course instructor.

Artificial Intelligence (AI) Course Policy

Broader use of Generative AI permitted within the course.

The use of artificial intelligence (AI) tools, including ChatGPT, is permitted in this course for students who wish to use it. Students must cite AI-generated material that informs their work. Using an AI tool to generate content without proper attribution qualifies as academic dishonesty.

Instructional Goals and Purposes

The purpose of this course is to teach the principles and procedures of urinalysis. The first phase of this course covers the study of macroscopic and microscopic structure of the kidney and the principles of renal function. The analysis of urine with specific application of techniques is included.

The second phase of this course covers the composition, formation, and functions of body fluids other than blood and urine. Included is the collection, processing, and laboratory analysis of body fluids. Throughout this course, special emphasis is placed on correlating or laboratory results with the patient's probable condition.

Learning Outcomes

1. Apply principles of safety, quality assurance and quality control.
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).

Specific Course Objectives (includes SCANS)

After studying all materials and resources presented in the course, the student will be able to:

(Laboratory objectives are listed in *italics*)

1. **Chapter 1 (1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**
 - a. *List six major Functions of the kidney and urinary system.*
 - b. *Diagram the kidney and the structures it contains.*
 - c. *Describe the process of glomerular filtration and list what is filtered and what is not filtered from blood*
 - d. *Define renal threshold and countercurrent mechanism. State the renal threshold range for glucose.*
 - e. *Discuss the reabsorption process and what is reabsorbed.*
 - f. *Summarize the process of tubular secretion in the nephron.*
 - g. *Explain the role of the kidney in ion secretion and acid–base balance and identify the roles of (a) hydrogen ions, (b) bicarbonate ions, and (c) ammonium ions in accomplishing this balance.*
 - h. *Describe the process of formation of urine.*
 - i. *Describe the effect of each of the following and their effect on urine production: (a) aldosterone have (b) renin, and (c) vasopressin (antidiuretic hormone [ADH]).*
2. **Chapter 2 & 3(1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**
 - a. *Define the following: Glomerulonephritis, nephrosis, glomerulosclerosis, cystitis, and pyelonephritis.*
 - b. *Describe and discuss the typical signs and symptoms of kidney stones, the types of stones, and laboratory tests that may be ordered for patients with stones.*
 - c. *Name a urinary finding that is diagnostic of renal tubular damage.*
 - d. *Differentiate between diabetic nephropathy, diabetes insipidus, and syndrome of inappropriate antidiuretic hormone.*
 - e. *List abnormal characteristics such as urinary odors, colors, crystals, and other laboratory findings.*
3. **Chapter 4(1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**
 - a. *Describe legal and ethical concerns related to the clinical laboratory.*
 - b. *Explain how the components of quality assessment are implemented in the clinical laboratory.*
 - c. *Explain the responsibility of laboratories to develop and publicize safety policies and procedures.*
 - d. *Identify and describe six types of safety risks that exist in the clinical laboratory.*
 - e. *Discuss the effective management of safety concerns in the clinical laboratory.*
 - f. *Comply with standard precautions; proper use of PPEs, handling of hazardous materials have and disposal of sharps in the laboratory.*
4. **Chapter 5 (1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**
 - a. *Identify the parts of a compound microscope.*
 - b. *Explain the function of each microscope component.*
 - c. *Explain methods used to adjust illumination.*
 - d. *Explain methods used to improve image contrast.*
 - e. *Outline proper handling and care of a microscope.*
5. **Chapter 6 (1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**
 - a. *Compare methods of urine collection.*
 - b. *Suggest appropriate urine collection method depending on testing ordered.*
 - c. *Compare urine preservation methods.*
 - d. *Select appropriate types of urine preservation depending on testing ordered.*
 - e. *Explain what changes occur in unpreserved urine over time.*
6. **Chapter 7 & 8 (1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**
 - a. *Explain what is included in physical examination of urine.*
 - b. *Identify normal and abnormal urine color and clarity.*
 - c. *Suggest causes for urine odor, color, and clarity.*
 - d. *Describe the methods for measuring urine concentration.*
 - e. *Judge whether a method for measurement of specific gravity needs correction for temperature and chemical effects.*
 - f. *State normal values for urine concentration.*
 - g. *Suggest causes for abnormal urine concentration.*
 - h. *Recognize and correct for sources for error when measuring urine concentration.*
 - i. *Explain what is included in physical examination of urine*
 - j. *Identify normal and abnormal urine color and clarity.*
 - k. *Suggest causes for urine odor, color, and clarity.*
7. **Chapters 9 & 10 (1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**

- a. *Describe the appearance of urine sediment using confirmatory methods of identification.*
- b. *Explain the formation of casts and their sequence of degeneration.*
- c. *Suggest the clinical significance of urine sediment.*
- d. *Identify crystals that may be found in acidic and alkaline urine.*
- e. *Identify casts and cells that may be found in urinary sediment.*
- f. *Identify microorganisms that may be found in urinary sediment.*
- g. *Differentiate between true urinary sediment and artifacts.*
8. **Chapter 11 (1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**
 - a. *Describe the main function of body fluids.*
 - b. *Explain the process of fluid accumulation in body cavities.*
 - c. *Name the procedure used to collect fluid from each body cavity.*
 - d. *List the tests that are normally performed on body fluids.*
 - e. *List the causes for abnormal appearance of body fluids.*
 - f. *Explain the use of a hemocytometer in performing body fluid cell counts.*
 - g. *Suggest techniques to minimize cell destruction during smear preparation.*
9. **Chapter 12 (1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**
 - a. *Explain the utility of cerebrospinal fluid analysis in evaluating the central nervous system.*
 - b. *Explain the function of cerebrospinal fluid and blood-brain barrier.*
 - c. *List the indications and contraindications for performing a cerebrospinal fluid analysis.*
 - d. *Compare and contrast the appearance of cerebrospinal fluid in health and disease.*
 - e. *Suggest tests on CSF to diagnose central nervous system disorders (meningitis, hemorrhage have etc.).*
 - f. *Differentiate between uncompromised and compromised cerebrospinal fluid results (hemorrhage vs. traumatic tap, side effects created by test procedures and interventions)*
 - g. *Identify cells normally present in cerebrospinal fluid.*
10. **Chapter 13 (1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**
 - a. *Define serous body fluids.*
 - b. *List the various serous body fluids and correlate to body cavity from which they are obtained.*
 - c. *Explain the formation of effusions.*
 - d. *Describe body fluid collection procedures and the risk involved during the procedure.*
 - e. *Differentiate between transudates and exudates using laboratory results.*
 - f. *Differentiate between chylous and pseudo-chylous effusions.*
 - g. *Describe the appearance of normal and abnormal body fluids.*
11. **Chapter 14 (1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**
 - a. *Define synovial.*
 - b. *Describe the formation and function of synovial fluid.*
 - c. *Explain the collection and handling of synovial fluid.*
 - d. *Describe the appearance of normal and abnormal synovial fluids.*
 - e. *Correlate the appearance of synovial fluid with possible cause.*
 - f. *Interpret laboratory tests on synovial fluid.*
12. **Chapter 15 (1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**
 - a. *Describe gastrointestinal tract physiology and fecal formation.*
 - b. *Explain mechanisms of diarrhea, including its relationship to reabsorption of intestinal water and hypermotility.*
 - c. *Compare disorders of the gastrointestinal tract.*
 - d. *Describe collection procedures for gastric fluid and fecal samples.*
 - e. *Describe the appearance of normal and abnormal gastric fluid and feces.*
 - f. *Describe laboratory testing for gastrointestinal tract disorders: enzymes, fecal carbohydrates have fecal fat, occult blood.*
 - g. *Interpret laboratory findings in various gastrointestinal tract disorders.*
13. **Chapter 16 (1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**
 - a. *Explain the process of spermatogenesis.*
 - b. *Explain the proper collection and specimen handling of semen samples.*
 - c. *Describe procedures for macroscopic and microscopic analysis of semen.*
 - d. *Identify normal and abnormal values for tests comprising a routine semen analysis.*
 - e. *Correlate results of semen analysis tests.*
 - f. *Identify and describe normal and abnormal spermatozoa morphologies.*

- g. *Identify and describe various sperm motilities.*
 - h. *Identify and describe the appearance of viable and nonviable spermatozoa.*
 - i. *Classify semen using parameters of count, motility, and morphology.*
14. **Chapter 17 (1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**
- a. *Explain the procedure and reasons for performing amniocentesis.*
 - b. *Define terminology associated with variation in amniotic fluid volume.*
 - c. *Discuss how to differentiate amniotic fluid from maternal urine.*
 - d. *Describe the testing available for genetic and congenital abnormalities.*
 - e. *Explain the disease process of hemolytic disease of the newborn.*
 - f. *Summarize testing available to detect hemolytic disease of the newborn.*
 - g. *Compare and contrast the amniotic fluid testing available for fetal lung maturity.*
15. **Chapter 18 (1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**
- a. *Explain the procedure collection and handling of vaginal secretion specimens.*
 - b. *Discuss the origin of substances present in amniotic fluid used in the diagnosing of rupture of fetal membrane (ROM).*
 - c. *Describe tests for detecting amniotic fluid in vaginal secretions.*
 - d. *Differentiate among various forms of vaginitis.*
 - e. *Describe laboratory tests for detection of atrophic vaginitis, desquamative inflammatory vaginitis, bacterial vaginosis, trichomoniasis, and candidiasis.*
 - f. *Summarize laboratory findings in normal vaginal secretions, atrophic vaginitis have desquamative inflammatory vaginitis, bacterial vaginosis, trichomoniasis, and candidiasis.*
16. **Chapters 19 & 20 (1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**
- a. *Explain what is detected in a pregnancy test and what may affect test results.*
 - b. *Explain the importance of testing for urine eosinophils.*
 - c. *Describe the collection of bronchial washings and the bronchoalveolar lavage.*
 - d. *Describe normal and abnormal findings for tests performed on bronchial specimens.*
 - e. *Describe methods for detection and identification of various microorganisms found in bronchial specimens from patients with various conditions.*
 - f. *State the rationales for using automated systems for urinalysis and body fluids examination.*
 - g. *List and describe the available automated urinalysis systems.*
 - h. *List and describe the available automated body fluid analysis systems*
17. **Lab #1 (1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**
- a. *Define proteinuria.*
 - b. *Describe how to use a urometer (hydrometer).*
 - c. *Define pH.*
 - d. *List factors that may cause a fluctuation of urine pH in vivo.*
 - e. *List abnormal urine colors and their causes.*
 - f. *Describe two things that can make a NORMAL urine cloudy in vitro.*
 - g. *List the 10 tests found on a urine reagent test strip.*
 - h. *Define "reducing substance."*
 - i. *Describe how to perform a "clinitest" and what the results mean.*
18. **Lab #2 (1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**
- a. *Describe/Identify the appearance of hyaline casts in urine microscopically.*
 - b. *Describe/Identify the appearance of WBC and RBCs in urine microscopically.*
 - c. *Identify sperm in urine microscopically and explain why the different reasons they appear in the urine of males and females.*
 - d. *Be able to distinguish artifacts from other urine components.*
 - e. *Identify the appearance of bacteria in urine. Discuss the importance of bacteria in different types of collection methods (void, clean catch, catheterized) and in males and females.*
 - f. *Distinguish between the following crystals: xray dye, Calcium Oxalate, Triple Phosphate.*
 - g. *List the NORMAL components of urine.*
 - h. *Identify mucus in urine microscopically.*
 - i. *Describe/Identify the appearance of epithelial cells in urine microscopically.*
 - j. *Name and explain the usage of each test (10) on the urine test strip.*
19. **Lab #3 (1a-i,ii,iii,iv,v. 1b-ii,iii,iv,v,vi. 1c-i,ii,iv,v. 2a-iii. 2c-i,ii,iii,iv)**
- a. *Describe the proper microscope procedure for use of a hemacytometer including cleaning and magnification.*

- b. *Describe the grid set up of a hemacytometer.*
- c. *Identify the measurements of the hemacytometer used to obtain the volume of the square (L x W x D)*
- d. *Describe the technique used for counting cells in the grid as "in" or "out."*
- e. *Describe the appearance of RBC, WBC, and artifacts on a hemacytometer.*
- f. *Be able to properly count RBC and WBC on a hemacytometer using appropriate magnification and rules.*
- g. *Know the formula to calculate the cellular content of a solution after counting via hemacytometer.*
- h. *Be able to dilute and properly "charge" a hemacytometer*

Course Content

A general description of lecture/discussion topics included in this course are listed in the Learning Objectives / Specific Course Objectives sections of this syllabus.

Methods of Instruction/Course Format/Delivery

This course is offered in an online format. However, there will be three mandatory Saturday labs, which will be listed along with their corresponding time by the instructor. Students will be fully responsible with keeping track of all assignments due dates, lab dates and time, as well as being aware of the testing center times for the four mandatory proctored exams.

Students are expected to demonstrate basic competency in reading, writing, oral communication, math have and computer skills. Proficiency will be measured by quizzes, assignments, laboratory assignments and quizzes, three regular examinations and a comprehensive final exam.

Major Assignments/Assessments

The following items are assigned and assessed during the semester and used to calculate the student's final grade.

Course Grade

The grading scale for this course is as follows:

- Lecture Grade = 2/3 of grade
- Lab Grade = 1/3 of grade
- Major Exams 50
- Quizzes 15%
- Homework Assignments 20%
- Final Exam 15%
- Pre-lab Quiz 10%
- Post-lab Quiz 10%
- Case Study/Project 15%
- In-lab assignment 40%
- Lab Practical 25%

Late assignments may be subject to a 15% late penalty.

Texts Materials, and Supplies

Graff's Textbook of Urinalysis and Body Fluids, 3rd Ed	Required	9781496320162	Mundt, Lillian, Shan	Jones & Bartlett
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Addendum

Mrs. Bishop's Student Office Hours

Monday: 12:00 PM - 2:00 PM PSC2302

Tuesday: 12:00 PM - 2:00 PM PSC2302

Wednesday: 8:00 AM - 10:00 AM PSC2302

Thursday: 12:00 PM - 2:00 PM PSC2302

Other

- Courses conducted via video conferencing may be recorded and shared for instructional purposes by the instructor.
- For current texts and materials, use the following link to access bookstore listings: <https://www.panolacollegestore.com>.
- For testing services, use the following link: <https://www.panola.edu/student-services/student-support/academic-testing-center>.
- If any student in this class has special classroom or testing needs because of a physical learning or emotional condition, please contact the ADA Student Coordinator in Support Services located in the Charles C. Matthews Student Center or go to <https://www.panola.edu/studentservices/student-support/disability-support-services> for more information.
- Withdrawing from a course is the student's responsibility. Students who do not attend class and who do not withdraw will receive the grade earned for the course.
- Student Handbook: <https://www.panola.edu/> (located on at the bottom under student)

SCANS Criteria

1. Foundation skills are defined in three areas: basic skills, thinking skills, and personal qualities.
 - a. Basic Skills: A worker must read, write, perform arithmetic and mathematical operations, listen, and speak effectively. These skills include:
 - i. Reading: locate, understand, and interpret written information in prose and in documents such as manuals, graphs, and schedules.
 - ii. Writing: communicate thoughts, ideas, information, and messages in writing, and create documents such as letters, directions, manuals, reports, graphs, and flow charts.
 - iii. Arithmetic and Mathematical Operations: perform basic computations and approach practical problems by choosing appropriately from a variety of mathematical techniques.
 - iv. Listening: receive, attend to, interpret, and respond to verbal messages and other cues.
 - v. Speaking: Organize ideas and communicate orally.
 - b. Thinking Skills: A worker must think creatively, make decisions, solve problems, visualize, know how to learn, and reason effectively. These skills include:
 - i. Creative Thinking: generate new ideas.
 - ii. Decision Making: specify goals and constraints, generate alternatives, consider risks, and evaluate and choose the best alternative.
 - iii. Problem Solving: recognize problems and devise and implement plan of action.
 - iv. Visualize ("Seeing Things in the Mind's Eye"): organize and process symbols, pictures, graphs, objects, and other information.
 - v. Knowing How to Learn: use efficient learning techniques to acquire and apply new knowledge and skills.
 - vi. Reasoning: discover a rule or principle underlying the relationship between two or more objects and apply it when solving a problem.
 - c. Personal Qualities: A worker must display responsibility, self-esteem, sociability, self management, integrity, and honesty.
 - i. Responsibility: exert a high level of effort and persevere toward goal attainment.
 - ii. Self-Esteem: believe in one's own self-worth and maintain a positive view of oneself.
 - iii. Sociability: demonstrate understanding, friendliness, adaptability, empathy, and politeness in group settings.
 - iv. Self-Management: assess oneself accurately, set personal goals, monitor progress, and exhibit self-control.
 - v. Integrity and Honesty: choose ethical courses of action.
2. Workplace competencies are defined in five areas: resources, interpersonal skills, information, systems, and technology.
 - a. Resources: A worker must identify, organize, plan, and allocate resources effectively.
 - i. Time: select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
 - ii. Money: Use or prepare budgets, make forecasts, keep records, and make adjustments to meet objectives.

- iii. **Material and Facilities:** Acquire, store, allocate, and use materials or space efficiently. Examples: construct a decision timeline chart; use computer software to plan a project; prepare a budget; conduct a cost/benefits analysis; design an RFP process; write a job description; develop a staffing plan.
- b. **Interpersonal Skills:** A worker must work with others effectively.
 - i. **Participate as a Member of a Team:** contribute to group effort.
 - ii. **Teach Others New Skills.**
 - iii. **Serve Clients/Customers:** work to satisfy customer's expectations.
 - iv. **Exercise Leadership:** communicate ideas to justify position, persuade and convince others, responsibly challenge existing procedures and policies.
 - v. **Negotiate:** work toward agreements involving exchange of resources, resolve divergent interests.
 - vi. **Work with Diversity:** work well with men and women from diverse backgrounds. Examples: collaborate with a group member to solve a problem; work through a group conflict situation, train a colleague; deal with a dissatisfied customer in person; select and use appropriate leadership styles; use effective delegation techniques; conduct an individual or team negotiation; demonstrate an understanding of how people from different cultural backgrounds might behave in various situations.
- c. **Information:** A worker must be able to acquire and use information.
 - i. **Acquire and Evaluate Information.**
 - ii. **Organize and Maintain Information.**
 - iii. **Interpret and Communicate Information.**
 - iv. **Use Computers to Process Information.** Examples: research and collect data from various sources; develop a form to collect data; develop an inventory record-keeping system; produce a report using graphics; make an oral presentation using various media; use on-line computer databases to research a report; use a computer spreadsheet to develop a budget.
- d. **Systems:** A worker must understand complex interrelationships.
 - i. **Understand Systems:** know how social, organizational, and technological systems work and operate effectively with them.
 - ii. **Monitor and Correct Performance:** distinguish trends, predict impacts on system operations, diagnose deviations in systems' performance and correct malfunctions.
 - iii. **Improve or Design Systems:** suggest modifications to existing systems and develop new or alternative systems to improve performance. Examples: draw and interpret an organizational chart; develop a monitoring process; choose a situation needing improvement, break it down, examine it, propose an improvement, and implement it.
- e. **Technology:** A worker must be able to work with a variety of technologies.
 - i. **Select Technology:** choose procedures, tools or equipment including computers and related technologies.
 - ii. **Apply Technologies to Task:** understand overall intent and proper procedures for setup and operation of equipment.
 - iii. **Maintain and Troubleshoot Equipment:** Prevent, identify, or solve problems with equipment, including computers and other technologies. Examples: read equipment descriptions and technical specifications to select equipment to meet needs; set up and assemble appropriate equipment from instructions; read and follow directions for troubleshooting and repairing equipment.