

South Plains College-Reese Center

Course Syllabus

COURSE: RADR 2309-200 (3:3:0), Radiographic Imaging Equipment
SEMESTER: Fall 2024
CLASS TIMES: TR, 9:30 – 10:45
INSTRUCTOR: Clinton Bishop
OFFICE: RC 512B
OFFICE HOURS: M-F 09:00 – 11:00 & by appointment
OFFICE PHONE: 806-716-4629
E-MAIL: cbishop@southplainscollege.edu

“South Plains College improves each student’s life.”

GENERAL COURSE INFORMATION

It is the responsibility of each student to be familiar with the content and requirements listed in the course syllabus.

COURSE DESCRIPTION

This course is a study of the equipment and physics of x-ray production, basic x-ray circuits and the relationship of conventional and digital equipment components to the imaging process.

COURSE OBJECTIVES

The student will:

1. Differentiate between conventional and digital equipment and relate these components to the imaging process.
2. Differentiate between electrostatics and electrodynamics.
3. List the laws of electrostatics.
4. Identify and differentiate between series, parallel and compound electric circuits.
5. Apply Ohm’s Law and the rules for series and parallel electric circuits.
6. Define direct current and alternating current.
7. Define the terms associated with magnetism and electromagnetism.
8. List the laws of magnetism.
9. Identify the laws of electromagnetic induction.
10. Identify the components of an electric generator, electric motor and transformer and describe their function.
11. Identify the components of an describe the x-ray circuit and describe their function
12. Identify the components of a beam restricting devices and radiographic grids.
13. Identify the characteristics of a diagnostic radiographic image.
14. Explains the physics of x-ray production.
15. Adjust the appropriate technical factor to produce a diagnostic radiographic image.
16. Identify the Quality Assurance procedures and acceptable parameters for specific parts of the x-ray imaging system and fluoroscopic imaging system

STUDENT LEARNING OUTCOMES

The student will:

1. Identify the components of a basic x-ray circuit and explain their role in x-ray production.
2. Identify the components of a fluoroscopic unit and explain their function.
3. Identify the components of various digital radiography systems and explain their function.
4. Differentiate between conventional and digital radiography systems.
5. Identify the essential quality control tests for radiographic, fluorographic and tomographic systems.
6. Describe the x-ray circuit.

EVALUATION METHODS

The course grade will be determined by a combination of major exams, a circuit board project, and a comprehensive final exam.

ACADEMIC INTEGRITY

It is the aim of the faculty of South Plains College to foster a spirit of complete honesty and a high standard of integrity. The attempt of any student to present as his or her own any work which he or she has not honestly performed is regarded by the faculty and administration as a most serious offense and renders the offender liable to serious consequences, possibly suspension.

Cheating - Dishonesty of any kind on examinations or on written assignments, illegal possession of examinations, the use of unauthorized notes during an examination, obtaining information during an examination from the textbook or from the examination paper of another student, assisting others to cheat, alteration of grade records, illegal entry or unauthorized presence in the office are examples of cheating. Complete honesty is required of the student in the presentation of any and all phases of coursework. This applies to quizzes of whatever length, as well as final examinations, to daily reports and to term papers.

Plagiarism - Offering the work of another as one's own, without proper acknowledgment, is plagiarism; therefore, any student who fails to give credit for quotations or essentially identical expression of material taken from books, encyclopedias, magazines and other reference works, or from themes, reports or other writings of a fellow student, is guilty of plagiarism.

If found cheating or plagiarizing, the student's future in this program will be based on the decisions from the Allied Health Departmental Director's Committee.

BLACKBOARD

Blackboard is an e-Education platform designed to enable educational innovations everywhere by connecting people and technology. This educational tool will be used in this course throughout the semester.

The student should only access his or her own Blackboard account. Granting permission to another or accessing another student's Blackboard account is prohibited and against the Academic Integrity code.

SOCIAL MEDIA

Facebook: <https://www.facebook.com/spradtechprogram>

Instagram: <https://www.instagram.com/spradtech/>

SCANS and FOUNDATION SKILLS

Scans and foundation skills are identified for specific course objectives. A complete list explaining these skills is attached to the back of the syllabus for your information.

COVID

If you are experiencing any of the following symptoms, please do not attend class and either seek medical attention or get tested for COVID-19.

- Cough, shortness of breath, difficulty breathing
- Fever or chills
- Muscles or body aches
- Vomiting or diarrhea
- New loss of taste and smell

Please also notify DeEtte Edens, BSN, RN, Associate Director of Health & Wellness, at dedens@southplainscollege.edu or 806-716-2376.

SPECIFIC COURSE INFORMATION

REQUIRED TEXT AND MATERIALS

Bushong, S.C., Radiologic Science for Technologists – Physics, Biology, & Protection. 12th Edition. 2021. Elsevier
-supplemental material provided by instructor

ATTENDANCE POLICY

SPC - Students are expected to attend all classes in order to be successful in a course. The student may be administratively withdrawn from the course when absences become excessive as defined in the course syllabus.

When an unavoidable reason for class absence arises, such as illness, an official trip authorized by the college or an official activity, the instructor may permit the student to make up work missed. It is the student's responsibility to complete work missed within a reasonable period of time as determined by the instructor. Students are officially enrolled in all courses for which they pay tuition and fees at the time of registration. Should a student, for any reason, delay in reporting to a class after official enrollment, absences will be attributed to the student from the first class meeting.

Students who enroll in a course but have "Never Attended" by the official census date, as reported by the faculty member, will be administratively dropped by the Office of Admissions and Records. A student who does not meet the attendance requirements of a class as stated in the course syllabus and does not officially withdraw from that course by the official census date of the semester, may be administratively withdrawn from that course and receive a grade of "X" or "F" as determined by the instructor. Instructors are responsible for clearly stating their administrative drop policy in the course syllabus, and it is the student's responsibility to be aware of that policy.

It is the student's responsibility to verify administrative drops for excessive absences through MySPC using his or her student online account. If it is determined that a student is awarded financial aid for a class or classes in which the student never attended or participated, the financial aid award will be adjusted in accordance with the classes in which the student did attend/participate and the student will owe any balance resulting from the adjustment.

SPC Radiologic Technology - Class attendance is mandatory. Students with three (3) absences will be counseled. Students are allowed five (5) absences during fall semester. After the fifth (5) absence, the student will be dropped from the program, regardless of the student's grade. Policies regarding absences coincide with those established for South Plains College as outlined in the SPC General Catalog.

An absence is an absence. The Radiologic Technology faculty do not distinguish between an excused and an unexcused absence.

It is extremely important that students arrive for class **on time**. **Tardiness** disrupts the instructor and the other students. Students who chronically arrive late will be counseled. The student should be prepared for class at the scheduled class start time. **3 tardy will equal 1 absence.**

Students with perfect attendance and two or less tardy will be awarded 2 points to their final grade at the end of the semester.

DROPS AND WITHDRAWALS

<http://www.southplainscollege.edu/admission-aid/apply/schedulechanges.php>

ADVISING

<http://www.southplainscollege.edu/admission-aid/advising/spcadvisors.php>

INSTRUCTIONAL METHODS

The student will receive course information through a series of lectures, PowerPoint presentations, lab assignments, and textbook assignments.

CLASSROOM PARTICIPATION

Attending class regularly will provide the student opportunity to supplement their reading assignments and acquire a better understanding of the course material. Class time missed will result in information gaps and will increase course difficulty. It is the student's responsibility to attend class which will enable him or her to take notes, ask questions, and participate in class discussions. Information handouts may be given in certain instances, but the student should not rely on them. The student is encouraged to take adequate notes during class. Recording class is permitted.

ASSIGNMENT POLICY

The student is responsible for being prepared for class, which means reading the assigned chapters and/or pages from the textbook prior to class. The textbook is a mandatory requirement. **The student must bring the textbook/e-book to every class.** In some instances, information from the reading assignments not covered during class may be included on an exam.

COMPUTER USAGE

As computer technology in the field of health occupations continues to become more popular, computers will be used in this course for several assignments. All students will have access to open computer lab and printers on the South Plains College campus. Students will be expected to utilize computers to access assignments and classroom resources. All registered students are supplied with a working email account from South Plains College. In order to take exams, students must have their user name and password.

ALL STUDENTS ARE EXPECTED TO KNOW THEIR SPC STUDENT USER NAME AND PASSWORD.

COMPUTER LAB USAGE

The open computer lab(s) on any campus may be used by students during scheduled open hours or as assigned by an instructor. Printer paper will not be provided for students to print materials, but students may seek assistance from faculty or staff to request lab paper from the college if needed. Lack of computer lab paper is not an excuse for not having homework assignments, skills lab sheets, or any other required documents. Students should come prepared for class.

REVIEW

If a student needs assistance with reviewing any of the information given during class or lab, the student is encouraged to make an appointment with the instructor.

CONFERENCES

If at any time a student is not satisfied with their overall performance, he/she is encouraged to schedule an appointment with me. If necessary, a plan can be developed to help the student improve in their areas of weakness.

GRADING RUBRIC

Grades in this course will be determined using the following criteria:

Assessment Tool	Assessment Criteria	Percentage Score	Grade
MAJOR EXAMS 40%	✓ Exceptional unit content knowledge & understanding	90 – 100	A
	✓ Good unit content knowledge & understanding	80 – 89	B
	✓ Average unit content knowledge & understanding	75 – 79	C
	✓ Unacceptable unit content knowledge & understanding	0 – 74	F
CIRCUIT BOARD PROJECT 15%	✓ Exceptional course content knowledge & understanding	90 – 100	A
	✓ Good course content knowledge & understanding	80 – 89	B
	✓ Average course content knowledge & understanding	75 – 79	C
	✓ Unacceptable unit content knowledge & understanding	0 – 74	F
FLIPPED CLASSROOM 15%	✓ Exceptional course content knowledge & understanding	90 – 100	A
	✓ Good course content knowledge & understanding	80 – 89	B
	✓ Average course content knowledge & understanding	75 – 79	C
	✓ Unacceptable unit content knowledge & understanding	0 – 74	F
FINAL EXAM 30%	✓ Exceptional course content knowledge & understanding	90 – 100	A
	✓ Good course content knowledge & understanding	80 – 89	B
	✓ Average course content knowledge & understanding	75 – 79	C
	✓ Unacceptable unit content knowledge & understanding	0 – 74	F

Course Grade: A	90 – 100
B	80 – 89
C	75 – 79
F	0 – 74

A grade average of C (75) or higher is mandatory in all RADR classes. Failure to do so will result in the student being dropped from the Program.

Major Exams – 40%

Major exams will be given throughout the semester following each module presented. Exams will be completed electronically in the computer lab.

The following guidelines will be followed regarding **Major Exams**:

1. The student will complete the exam at the scheduled time. **Make-up exams will be at the instructor's discretion.**
2. The student must complete the exam within the allotted class time of **75 minutes**.
3. If a major exam is missed, a zero will be recorded in the gradebook for that exam.
4. A student arriving late for an exam will not be allowed to take the exam if **any** student has completed the exam and left the room. This will also count as a tardy.
5. No cell phones, smartwatches, calculators, or other electronic assistance devices are allowed during exams.
6. Major exams are not available to print or save. Once you have finished your exam, please review the exam. Students may review exams in the instructor's office by appointment.

After TWO failed exams in a RADR course it is mandatory that the student:

- will meet with the instructor of that course and the Early Alert process will be initiated.
- will meet with an academic advisor/counselor before the next exam of that course.
- submit documentation to the instructor of the academic advisor/counselor meeting.

Circuit Board Project – 15%

The circuit board project will be completed as a group and will aid in the understanding of the x-ray electrical circuit. All supplies for the project will be provided.

The following guidelines will be followed regarding **Circuit Board Project**:

1. The student's participation within the group.
2. The verbal presentation of the project.
3. The understanding of the circuit components.
4. The overall neatness of the project.

Flipped Classroom – 15%

The flipped classroom presentation will be completed as a group. Each group will be assigned a subject matter and present the material to the class.

The following guidelines will be followed regarding **Flipped Classroom**:

1. The student's participation within the group.
2. The student's verbal presentation of the material.
3. The student's knowledge and understanding of the material.

Final Exam – 30%

A comprehensive final exam will be given at the end of the semester. Two hours will be allotted for the final exam which will be completed electronically in the computer lab.

The following guidelines will be followed regarding the **Final Exam**:

1. The final exam will be comprehensive.
2. The final exam must be completed within the allotted time, **2 hours**.
3. A student arriving late for an exam will not be allowed to take the final exam if **any** student has completed the exam and left the room.
4. No cell phones, smartwatches, calculators, or other electronic assistance devices are allowed during final exam.
5. If the final exam is missed, a zero will be recorded in the gradebook for that exam.
6. The final exam is not available to print or save. Once you have finished your exam, please review the exam. Students may review the final exam in the instructor's office by appointment.

COMMUNICATION POLICY

Electronic communication between instructor and students in this course will utilize the South Plains College email system and GroupMe. Instructor will not initiate communication using private email accounts. Students are encouraged to check SPC email & GroupMe on a daily basis.

STUDENT CONDUCT

Students in this class are expected to abide by the standards of student conduct as defined in the SPC Student Guide and the Radiologic Technology Program Student Handbook.

Rules and regulations relating to the students at South Plains College are made with the view of protecting the best interests of the individual, the general welfare of the entire student body and the educational objectives of the college. As in any segment of society, a college community must be guided by standards that are stringent enough to prevent disorder, yet moderate enough to provide an atmosphere conducive to intellectual and personal development.

A high standard of conduct is expected of all students. When a student enrolls at South Plains College, it is assumed that the student accepts the obligations of performance and behavior imposed by the college relevant to its lawful missions, processes and functions. Obedience to the law, respect for properly constituted authority, personal honor, integrity and common sense guide the actions of each member of the college community both in and out of the classroom.

Students are subject to federal, state and local laws, as well as South Plains College rules and regulations. A student is not entitled to greater immunities or privileges before the law than those enjoyed by other citizens. Students are subject to such reasonable disciplinary action as the administration of the college may consider appropriate, including suspension and expulsion in appropriate cases for breach of federal, state or local laws, or college rules and regulations. This principle extends to conduct off-campus which is likely to have adverse effects on the college or on the educational process which identifies the offender as an unfit associate for fellow students.

Any student who fails to perform according to expected standards may be asked to withdraw.

Rules and regulations regarding student conduct appear in the current Student Guide.

CELL PHONES

Cellphones must be put away and are to be turned **OFF** or put on **silent** during scheduled class/lab periods, unless prior approval has been given from the instructor. Cell phones are to be used only outside of the classroom while class is in session. **This includes text messaging and/or internet browsing.**

Students will be dismissed from class/lab and sent home if a phone continuously rings/vibrates or if the student is discovered texting or browsing the internet. If dismissed from class, the student will receive an **absence** for the day. In case of emergencies, the student can also be reached by calling the front desk at (806)716-4622.

SPC SYLLABUS STATEMENTS (ACCOMMODATIONS)

<https://www.southplainscollege.edu/syllabusstatements/>

COURSE OUTLINE

Fluoroscopy

The student will:

1. Discuss the development of fluoroscopy.
2. Explains visual physiology and its relationship to fluoroscopy.
3. Describe the components of an image intensifier.
4. Calculate brightness gain and identify its units.
5. List the common kVp levels for common fluoroscopic examinations.
6. Discuss the role the television monitor and the television image in forming fluoroscopic images.

Digital Fluoroscopy

The student will:

1. Explain the fundamentals of digital fluoroscopy (F10; C5,6,15)
2. Differentiate between digital fluoroscopy conventional radiography. (F10; C5,6,15)
3. Identify the physical principles of digital fluoroscopy. (F10; C5,6,15)
4. Identify the significance of the digital fluoroscopy.
5. Identify the components of the digital fluoroscopy system. (F10; C5,6,15)
6. Discuss the safety of digital fluoroscopy.
7. Identify the imaging parameters of a digital fluoroscopy protocol. (F10; C5,6,15)
8. Discuss the positioning of the digital fluoroscopy patient.
9. Discuss the issues of patient monitoring during a digital fluoroscopy procedure.
10. Discuss the use of contrast media in digital fluoroscopy.
11. Identify the clinical applications of digital fluoroscopy.

Electricity, Magnetism & Electromagnetism

The student will:

1. Define *electrostatics*.
2. Identify the methods of electrification.
3. Identify the unit of measure for *electric charge*.
4. Identify the laws of electrostatics.
5. Identify Coulomb's Law.
6. Identify the unit of measure for *electric potential*.
7. Define *electrodynamics*.
8. Identify the unit of measure for *electric current*.
9. Define and differentiate between superconductor, conductor, semiconductor and insulator.
10. Identify typical materials used as a superconductor, conductor, semiconductor and insulator.
11. Identify and describe the elements of a basic electric circuit.
12. Differentiate between electron flow and conventional electric current. (F10)
13. Identify the unit of measure for *electrical resistance*.
14. Identify the factors and explain how they affect electrical resistance.
15. State *Ohm's Law*.
16. Differentiate between a series, parallel and compound electric circuit. (F10)
17. Calculate the resistance, current and/or electric potential of an electric circuit using Ohm's law and the rules for parallel and series circuits. (F3,10,12)
18. Identify the unit of measure for *power*.
19. Calculate the power of an electric circuit. (F3,10,12)
20. Compare the sine curves of direct and alternating electric currents. (F10)
21. Explain the atomic nature of magnetism. (F10)
22. State the laws of magnetism.
23. Describe a magnetic field.
24. Identify the characteristics of magnetic lines of force (magnetic flux).
25. Differentiate between magnetic permeability and retentivity. (F10)
26. Classify materials according to their magnetic properties.
27. Define magnetic force.
28. Identify the units of measure for the total number of magnetic flux lines and magnetic field strength (intensity).
29. Define *electromagnetism*.
30. Differentiate between a helix, solenoid and an electromagnet. (F10)
31. Describe *electromagnetic induction*.
32. State *Faraday's Law* and *Lenz's Law*.
33. Identify the factors that affect the magnitude of an induced current.
34. Differentiate between mutual induction and self-induction.
35. Define *inductive reactance* and identify its unit of measure.

36. Define *impedance*.
37. Apply *Fleming's Hand Rules of Electromagnetics* in identifying the electron flow and magnetic field of a current carrying wire.
38. Identify the components and function of an electric generator.
39. Identify the components and function of an electric motor.
40. Differentiate between an alternating current and direct current generator and motor. (F10,12)
41. Identify the use of an induction motor in the x-ray machine.
42. Identify the components and function of an electromagnetic transformer.
43. Differentiate between the different types of transformer construction. (F10,12)
44. Identify and explain the various types of power loss in a transformer.
45. Differentiate between a step-up transformer, step-down transformer and an autotransformer. (F10,12)
46. Calculate problems using the Transformer Law formula. (F3)
47. Describe and explain the function of a *capacitor*.
48. Identify the unit of measure for *capacitance*.
49. Calculate capacitance.
50. Define *time constant* of a capacitor.
51. Calculate the *time constant* of a capacitor.
52. Define *capacitive reactance* and its unit of measure.

The X-Ray Imaging System

The student will:

1. Identify the controls and meters of the operating console positioned outside the x-ray examination room.
2. Define *line voltage*.
3. Describe the purpose of *line voltage compensation*.
4. Explain the function of the *autotransformer* in the x-ray circuit.
5. Identify the various exposure timers used in x-ray circuits and their methods of operation.
6. Identify the components of the high-voltage generator.
7. Explain the function of the high voltage transformer in the x-ray circuit.
8. Define rectification.
9. Identify the two types of rectifiers available for x-ray circuits.
10. Identify the construction of a solid-state rectifier.
11. Predict the results of various combinations of defective rectifiers in an x-ray circuit (F9-12;C15,16)
12. Trace the path of electron flow during the positive and negative half-cycles using a schematic of a full-wave, single-phase rectification x-ray circuit. (F10)
13. Identify and describe the components of the filament circuit and the role each plays in x-ray production. (F10)
14. Differentiate between single-phase, three-phase, high-frequency and capacitor discharge generators. (F10,12)
15. Define voltage ripple.
16. Identify and differentiate between the voltage ripples of single-phase, three-phase, high-frequency and capacitor discharge generators. (F10,12)
17. Identify and explain the function of all components of a typical x-ray circuit.
18. Identify the characteristics, advantages and disadvantages of these mobile x-ray units: battery-operated, capacitor-discharge and falling-load. (F10,12)

The X-Ray Tube

The student will:

1. Identify the components of an x-ray tube and describe the function of each in the production of x-rays. (F10,12)
2. Explain how the energy of the resulting x-rays is related to the voltage applied across the x-ray tube electrodes.
3. Differentiate between filament current and tube current. (F10)
4. Explain the relationship between filament current and tube current. (F10,12)
5. Describe the design of stationary and rotating anodes, identifying the advantages and disadvantages of each. (F10,12)
6. Explain the line focus principle.
7. Explain the relationship between the size of the filament and the size of the focal spot. (F12)
8. Explain the effects of the line focus principle on heat capacity and radiographic detail. (F10,12)

9. Describe the cause of anode heel effect and its impact on x-ray beam intensity and optical density. (F12)
9. Identify the purpose of the protective housing of an x-ray tube. (F10)
10. Determine safe technical factors using radiographic rating charts and anode cooling charts. (F1,8-10,12;C5-7, 15,16,18-20)

Scatter Control

The student will:

1. Identify the x-rays that constitute image-forming radiation.
2. Recognize the relationship between scatter radiation and image contrast.
3. List three factors that contribute to scatter radiation.
4. Discuss three devices developed to minimize scatter radiation.
5. Describe beam restriction and its effect on patient radiation dose and image quality.
6. Describe grid constructions and its measures of performance.
7. Evaluate the use of various grids in relation to patient dose.

Computed Radiography

The student will:

1. Describe the process of computed radiography (CR).
2. Identify and describe the components of a CR image receptor.
3. Describe photostimulable luminescence (PSL).
4. Identify and describe the process of producing a CR image: exposure, stimulation, reading and erasing.
5. Describe spatial resolution, contrast resolution and radiographic noise related to computed radiography.
6. Identify the sources of image noise in computed radiography.
7. Identify opportunities for patient radiation dose reduction using computed radiography.
8. Identify the recommended radiation exposure for CR.
9. Identify the advantages and disadvantages of CR.

Digital Radiography

The student will:

1. Identify the advantages of digital radiography over screen-film radiography.
2. Identify the digital radiographic modes.
3. Differentiate between direct digital radiography and indirect digital radiography.
4. Describe the capture, coupling and collection stages of each type of digital radiographic imaging system.
5. Identify the characteristics of a charge-coupled device (CCD).
6. Describe the function, sensitivity and dynamic range of a CCD.
7. Identify the characteristics of scanned projection radiography (SPR).
8. Differentiate between direct and indirect exposure DR imaging systems.
9. Describe the process of image formation using a direct selenium flat panel imaging plate.
10. Describe the process of image formation using an indirect silicon flat panel imaging plate.
11. Describe the construction of direct and indirect cassette-less digital radiography systems.
12. Discuss the use of silicon, selenium, cesium iodide and gadolinium oxysulfide in digital radiography.

Viewing Digital Radiographic Image

The student will:

1. Identify quantities and units used in photometry.
2. Explain the variations in luminous intensity of digital display devices.
3. Describe differences in hard copy and softy copy and in interpretation of each.

4. Discuss the features of an active matrix liquid crystal display.
5. Describe the features of preprocessing and postprocessing.
6. Identify application of the picture archiving and communication system.

Digital Radiography Artifacts

The student will:

1. Discuss the three types of digital radiographic imaging artifacts and how to avoid them.
2. Identify the difference between for-processing images and for-presentation images.
3. Describe the basis for data compression and the difference between lossless and lossy compression.
4. Analyze the use of an image histogram in digital radiographic image artifacts.
5. Explain how digital radiographic image artifacts occur because of improper collimation, partition, or alignment.

Digital Radiography Quality Control

The student will:

1. Describe various factors associated with the performance of digital display devices.
2. Explain the various test patterns suggested by AAPM TG 18 on digital display device performance assessment.
3. Discuss the quality control tests and schedule used for digital display devices.

FOUNDATION SKILLS

BASIC SKILLS—Reads, Writes, Performs Arithmetic and Mathematical Operations, Listens and Speaks

F-1 Reading—locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules.

F-2 Writing—communicates thoughts, ideas, information and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts.

F-3 Arithmetic—performs basic computations; uses basic numerical concepts such as whole numbers, etc.

F-4 Mathematics—approaches practical problems by choosing appropriately from a variety of mathematical techniques.

F-5 Listening—receives, attends to, interprets, and responds to verbal messages and other cues.

F-6 Speaking—organizes ideas and communicates orally.

THINKING SKILLS—Thinks Creatively, Makes Decisions, Solves Problems, Visualizes and Knows How to Learn and Reason

F-7 Creative Thinking—generates new ideas.

F-8 Decision-Making—specifies goals and constraints, generates alternatives, considers risks, evaluates and chooses best alternative.

F-9 Problem Solving—recognizes problems, devises and implements plan of action.

F-10 Seeing Things in the Mind’s Eye—organizes and processes symbols, pictures, graphs, objects, and other information.

F-11 Knowing How to Learn—uses efficient learning techniques to acquire and apply new knowledge and skills.

F-12 Reasoning—discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem.

PERSONAL QUALITIES—Displays Responsibility, Self-Esteem, Sociability, Self-Management, Integrity and Honesty

F-13 Responsibility—exerts a high level of effort and perseveres towards goal attainment.

F-14 Self-Esteem—believes in own self-worth and maintains a positive view of self.

F-15 Sociability—demonstrates understanding, friendliness, adaptability, empathy and politeness in group settings.

F-16 Self-Management—assesses self accurately, sets personal goals, monitors progress and exhibits self-control.

F-17 Integrity/Honesty—chooses ethical courses of action.

SCANS COMPETENCIES

C-1 **TIME** - Selects goal - relevant activities, ranks them, allocates time, prepares and follows schedules.

C-2 **MONEY** - Uses or prepares budgets, makes forecasts, keeps records and makes adjustments to meet objectives.

C-3 **MATERIALS AND FACILITIES** - Acquires, stores, allocates, and uses materials or space efficiently.

C-4 **HUMAN RESOURCES** - Assesses skills and distributes work accordingly, evaluates performances and provides feedback.

INFORMATION - Acquires and Uses Information

C-5 Acquires and evaluates information.

C-6 Organizes and maintains information.

C-7 Interprets and communicates information.

C-8 Uses computers to process information.

INTERPERSONAL–Works With Others

C-9 Participates as a member of a team and contributes to group effort.

C-10 Teaches others new skills.

C-11 Serves Clients/Customers–works to satisfy customer’s expectations.

C-12 Exercises Leadership–communicates ideas to justify position, persuades and convinces others, responsibly challenges existing procedures and policies.

C-13 Negotiates–works toward agreements involving exchanges of resources; resolves divergent interests.

C-14 Works With Diversity–works well with men and women from diverse backgrounds.

SYSTEMS–Understands Complex Interrelationships

C-15 Understands Systems–knows how social, organizational, and technological systems work and operates effectively with them.

C-16 Monitors and Corrects Performance–distinguishes trends, predicts impacts on system operations, diagnoses systems performance and corrects malfunctions.

C-17 Improves or Designs Systems–suggests modifications to existing systems and develops new or alternative systems to improve performance.

TECHNOLOGY–Works with a Variety of Technologies

C-18 Selects Technology–chooses procedures, tools, or equipment, including computers and related technologies.

C-19 Applies Technology to Task–understands overall intent and proper procedures for setup and operation of equipment.

C-20 Maintains and Troubleshoots Equipment–prevents, identifies, or solves problems with equipment, including computers and other technologies.