

## COURSE SYLLABUS

**Course Title:** AUMT 2413-271 Automotive Manual Drive Trains & Axles (4:2:8)

**Semester/Year:** Fall 2017

**Instructor:** Mr. Marc Wischkaemper

**Office/Location:** Lubbock Center, 3907 Ave, Q. Room 136C

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**Office Hours:** Check posted hours after classes begin, or by appointment.

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#### I. GENERAL COURSE INFORMATION

- A. Course Description:** (4:2:8) - This course is a study of automotive clutches, clutch operation devices, standard transmissions, transaxles, and differentials with emphasis on the diagnosis and repair of transmissions and drivelines. Elements of the course may be taught manufacturer specific.
- B. Course Goals/Objectives:** Utilizing the appropriate safety procedures, the student will determine driveline problems by test driving the vehicle; make positive diagnosis by disassembly and inspection; make proper repairs to clutches, transmissions, transaxles, and differentials; and make proper repairs to constant velocity joints and universal joints.
- C. Course Competencies:** A = 100-90 B = 89-80 C = 79-70 F = 69 or below.  
  
A grade of C or higher is required in AUMT 2413 in order to successfully complete this course.
- D. 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 own, any work which he 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. For further information concerning Cheating and Plagiarism, read the section on Academic Integrity in the SPC General Catalog. **If you have a question as to whether you may work with other students on any assignment, ASK YOUR INSTRUCTOR. On some assignments, working with others is encouraged.**

- E. SCANS and Foundation Skills:** Specific SCANS competencies and foundation skills applicable to this course are listed adjacent to each objective in the course objective table. They include: Foundation Skills (F): 1,2,3,4,5,6,8,9,10,11,12  
Competencies (C) : 5,6,7,14,15,16,18,19,20  
A complete list of SCANS competencies and foundation skills is attached at the end of this syllabus.
- F. Verification of Workplace Competencies-Technical Education Division.** The learning outcomes of this course will prepare the student to meet the competencies measured in a comprehensive elective course experience (Course # AUMT 1366, or AUMT 2366). In addition the student will also be prepared to take the ASE Student Certification test for Manual Drive Trains & Axles.

## II. SPECIFIC COURSE/INSTRUCTOR REQUIREMENTS

- A. Textbook & Other Required Materials:**  
Halderman, James D. Automotive Technology Principles, Diagnosis, and Service, Fifth Edition, Pearson Publishers, 2016 (with on-line curriculum)  
8 ½ x 11 notebook for classroom note taking and assignments  
Clear Safety Glasses.
- B. Attendance Policy:** Satisfactory course completion requires classroom/lab attendance and participation. There are no excused absences. If extenuating circumstances arise which do not permit attendance, the instructor must be notified before class. Absences on four (4) consecutive days or a total of five (5) absences in the semester will result in administrative withdrawal by the instructor. **Two (2) tardies count as one (1) absence.**  
**Leaving class without notifying your instructor is considered an absence, regardless of time you left.**
- C. Assignment Policy:** All assignments are due at the beginning of class on the due dates unless otherwise instructed. Assignments may include on-line or off-line review questions, short essay questions, and definitions. **Part of these assignments can be on-line through the on-line curriculum, you should log on to the on-line curriculum at the beginning of the semester in order to complete them on time. There will be no makeup assignments and no late assignments accepted.** The dates printed in this syllabus can change. Every effort will be made to inform the students of those changes, but the students are ultimately responsible for all assignments regardless of any changed dates. Please check the dates with your instructor throughout the course.

- D. Grading Policy/ Procedure and/or Methods of Evaluation:** All exams including the final exam are mandatory for effective student evaluation. Exams will be objective and will cover both theory and practical skills pertaining to all aspects of the material presented. Adequate study time should be set aside for exam reviews. **There will be No makeup exams - no exceptions. If a student's financial records are not clear at the time for finals *the student will not be allowed to take the final exam.***

You will be evaluated during this course by the following method:

Unit exams, written assignments, pop quizzes, and attendance = 25%

Unit skills tests/Lab sheets = 50% (approximately 4)

Final Exam = 25%

A unit skills test is a measure of how well you follow instructions, your safety in the shop, your use of tools your cleanliness in the work area and your attention to detail while you perform diagnostics or repairs within a required time period.

A task sheet is used to plan and track students while they perform required skills in the shop. This is not used to average your grade, but it is a professional evaluation of how well you work independently and your level of expertise in completing assigned tasks. Prospective employers will want to see this during an interview, so please follow the shop and repair procedures to the best of your ability.

- E. Special Requirements:** **A student's conduct is expected to follow the guidelines stated in the college catalogue and student handbook, any deviation will result in immediate disciplinary action.** **No smoking, chewing, or dipping is permitted in the building or outside the back doors of the shop and food and drinks are not allowed in any classroom, lab, or shop.** All these activities will be limited to break time in designated areas only. Breaks will be limited to 20 minutes. Do not park on the back lot unless preauthorized by your instructor, unauthorized vehicles can be towed at the owner's expense.

**Dress Code:** The Automotive Program requires you to dress appropriately. Flip flops or opened toed shoes are not allowed in the shop, proper foot attire should be worn to protect your feet, leather work boots are recommended. Jeans/ pants will be worn so that neither one falls to your thighs or knees, belts must hold them at your waist line. Safety glasses will be worn at all times in the shop. If a student fails to comply with the above dress code, he or she, will be sent home and given an absence for that day.

# **LUBBOCK CAMPUS GUIDELINES**

## **CHILDREN ON CAMPUS**

Many of the students attending classes at South Plains College - Lubbock Camps are also parents who value the opportunity to participate in higher education. Sometimes students are faced with the decision of whether to remain at home with their children, bring children with them to class, or be absent from class. The following guidelines address concerns for the safety of children on campus and provide for an environment conducive to learning.

## **CHILDREN IN THE CLASSROOM**

**Students are not allowed to bring children to class** and will be asked to leave in the interest of providing an environment conducive for **all** students enrolled in the class. Students are responsible for adherence to the attendance requirements set forth by the instructor in the course syllabus.

## **UNATTENDED CHILDREN ON CAMPUS**

**Children may not be left unattended.** In order to provide for the safety of children on campus, parents or other guardians are responsible for supervising children while utilizing services or conducting business on campus.

## **DISRUPTIVE CHILDREN**

**Disruptive children will not be allowed to interfere with college business.** Parents or other guardians are responsible for supervising and controlling the behavior of children they have brought on campus.

## **ADA Statement**

Students with disabilities, including but not limited to physical, psychiatric, or learning disabilities, who wish to request accommodations in this class should notify the Disability Services Office early in the semester so that the appropriate arrangements may be made. In accordance with federal law, a student requesting accommodations must provide acceptable documentation of his/her disability to the Disability Services Office. For more information, call or visit the Disability Services Office at Levelland (Student Health & Wellness Office) 806-716-2577, Reese Center (Building 8) & Lubbock Center 806-716-4675, or Plainview Center (Main Office) 806-716-4302 or 806-296-9611.

## **GENERAL SAFETY ON CAMPUS**

South Plains College recognizes the importance of safety on campus. The protection of persons and property is a responsibility which we all share. Personal safety begins with the individual. The following guidelines are intended to assist you in protecting yourself and to encourage practices that contribute to a safe environment for our campus community.

- Never leave your personal property unsecured or unattended.
- Look around and be aware of your surroundings when you enter and exit a building.
- Whenever possible, avoid walking alone, particularly after dark. Walk to your vehicle with other class members or request that the Security Guard walk you to your car.
- When approaching your vehicle, keep your keys in your hand; look under your car and in the back seat and floorboard. Lock the doors as soon as you are inside your car.

## **FOOD AND DRINK IN CLASSROOMS**

It is the policy of South Plains College not to permit food or drink in the classrooms or laboratories.

<p><b>In case of emergency, contact the following numbers, but DO NOT leave a voice mail message.</b> <b>716-4677, - ATC    716-2923, - Reese Center (mobile 806-893-5705)</b></p>
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	<p><b>VII. Course Objectives</b></p>	
F1,2,5,6,10	<p>Upon completion of this course, students will be able to:</p> <ul style="list-style-type: none"> <li>• Understand the operation of the components making up the drive train.</li> </ul>	C5,7,15
F1-5,8-12	<ul style="list-style-type: none"> <li>• Explain how gear ratios relate to torque and how to compute gear ratios.</li> </ul>	C5,7,15
F1,2,5,6,8,12	<ul style="list-style-type: none"> <li>• Identify various types of clutch assemblies and discuss how they operate.</li> </ul>	C5,7,15
F1-5, 8-12	<ul style="list-style-type: none"> <li>• Adjust the clutch linkage on a vehicle remove and replace a clutch, pressure plate assembly, release bearing and pilot bearing.</li> </ul>	C5,7,15,16, 18,19
F1-5,8-12	<ul style="list-style-type: none"> <li>• Check and correct clutch housing alignment.</li> </ul>	C5,7,15,16, 18,19
F1-5,8-12	<ul style="list-style-type: none"> <li>• Diagnose problems associated with clutch operation.</li> </ul>	C5,7,15,16, 18,19
F1,2,5,6,8	<ul style="list-style-type: none"> <li>• Discuss the purpose and operation of a typical manual transmission or transaxle.</li> </ul>	C5,7,15,16, 18,19
F1,2,5,6,8	<ul style="list-style-type: none"> <li>• Discuss the importance of using the proper lubricants in manual transmission or transaxle.</li> </ul>	C5,7,15
F1,2,5,6,8-12	<ul style="list-style-type: none"> <li>• List and discuss possible sources of leaks on a manual transmission or drive axle.</li> </ul>	C5,7,15
F1-5,8-12	<ul style="list-style-type: none"> <li>• Remove, adjust, repair and reinstall a manual transmission.</li> </ul>	C5,7,15,16
F1,2,5,8,12	<ul style="list-style-type: none"> <li>• Identify and discuss the different types of joints in a driveline.</li> </ul>	C5,7,15,16, 18-20
F1-5,8-12	<ul style="list-style-type: none"> <li>• Remove, inspect, and replace different types of driveline joints.</li> </ul>	C5,7,15
F1,2,5,8,12	<ul style="list-style-type: none"> <li>• Identify and discuss different types of differentials and how they operate.</li> </ul>	C5,7,15,16, 18-20
F1-5,8-12	<ul style="list-style-type: none"> <li>• Diagnose problems in the differential.</li> </ul>	C5,7,15
F1-5,8-12	<ul style="list-style-type: none"> <li>• Remove, inspect, repair and reinstall differentials.</li> </ul>	C5-7,14,16, 18-20
		C5-7,15,16, 18-20

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	<p><b>VIII. Content Outline</b></p> <p><b>Unit 1: Power Train Components and Clutch Service</b></p> <p>Unit Objectives:</p>	
F1,2,5,6,8-12	Upon completion of this unit, the student will be able to:	C5-7,15
F1-6,8-12	<ul style="list-style-type: none"> <li>Identify the components of the power train and discuss the operation of each.</li> </ul>	C5-7,15
F1,2,5,6,8	<ul style="list-style-type: none"> <li>Explain how gear ratios relate to torque and how to compute gear ratios.</li> </ul>	C5-7,15
F1,2,5,6,8,12	<ul style="list-style-type: none"> <li>Distinguish differences between a front wheel drive power train and a rear wheel drive power train.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>Discuss how various types of clutches operate and distinguish how they differ in construction.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>Diagnose clutch problems- determine needed repairs.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>Inspect, adjust, and replace clutch mechanical controls.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>Inspect, adjust, and replace clutch hydraulic system controls.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>Remove, repair, reinstall, and adjust various clutch assemblies.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>Inspect, service, or replace flywheel ring gear.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>Inspect mating surfaces of the engine block, clutch housing, or transmission case for needed repairs.</li> </ul>	C5-7,15,16,18-20

	<p><b>Unit 2: Manual Transmission/Transaxle Operation, Diagnosis, and Repair</b></p> <p>Unit Objectives:</p> <p>Upon completion of this unit, students will be able to:</p>	
F1,2,5,6,8,12	<ul style="list-style-type: none"> <li>• Discuss the purpose and determine the operation of typical manual transmissions and transaxles.</li> </ul>	C5-7,15
F1,2,5,6,8,12	<ul style="list-style-type: none"> <li>• Discuss the importance of road testing a vehicle with the customer.</li> </ul>	C5-7,15
F1,2,5,6,8,12	<ul style="list-style-type: none"> <li>• Distinguish the differences between three-speed, four-speed, and five-speed transmissions.</li> </ul>	C5-7,15
F1,2,5,6,8,12	<ul style="list-style-type: none"> <li>• Discuss the different jobs of gear lubricant and the importance of using proper gear lube.</li> </ul>	C5-7,15
F1-6,8-12	<ul style="list-style-type: none"> <li>• Diagnose transmission/transaxle noises, shifting, and fluid leakage problems; determine needed repairs.</li> </ul>	C5-7,15,16, 18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Inspect, adjust, or replace column or floor shift levers and linkages.</li> </ul>	C5-7,15,16, 18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Inspect, adjust, or replace transmission/transaxle shift cover assemblies.</li> </ul>	C5-7,15,16, 18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Disassemble, clean, inspect, repair or replace transmission/transaxle sealing surfaces, gaskets, and seals.</li> </ul>	C5-7,15,16, 18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Disassemble, clean, inspect, repair or replace transmission/transaxle internal shafts, gears, synchronizers, bearings, and bushings.</li> </ul>	C5-7,15,16, 18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Reassemble transmission/transaxle and properly adjust endplay and bearing preload on all shafts and gears.</li> </ul>	C5-7,15,16, 18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Diagnose transaxle/differential case assembly noises and vibration; determine needed repairs.</li> </ul>	C5-7,15,16, 18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Remove, inspect, and repair a transaxle final drive/differential case.</li> </ul>	C5-7,15,16, 18-20

	<p><b>Unit 3: Differential and Drive Axles</b></p> <p>Unit Objectives:</p> <p>Upon completion of this unit, the student will be able to:</p>	
F1,2,5,6,8,12	<ul style="list-style-type: none"> <li>• Explain the operation and construction of a differential.</li> </ul>	C5-7,15
F1,2,5,6,8,12	<ul style="list-style-type: none"> <li>• Explain the difference between full floating and semi-floating axles.</li> </ul>	C5-7,15
F1-6,8-12	<ul style="list-style-type: none"> <li>• Diagnose noises, vibrations, and fluid leakage problems; determine needed repair.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Inspect and replace companion flange and pinion seal.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Inspect ring gear and measure run out; determine needed repair.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Remove, inspect, and replace pinion gear, spacers, sleeves, and bearings.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Measure and adjust pinion depth.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Measure and adjust pinion bearing preload.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Measure and adjust side bearing preload and backlash on a carrier assembly.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Check ring and pinion tooth contact pattern; make needed adjustments.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Disassemble, inspect, measure, adjust or replace differential case assembly.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Inspect and replace differential side bearings.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Repair and install case assembly; measure run out; repair as needed.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Diagnose rear axle shaft for noise, vibration, or leaks; determine needed repairs.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Inspect and replace rear axle shaft wheel studs.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Remove, inspect, and replace rear axle shafts, seals, bearings, and retainers.</li> </ul>	C5-7,15,16,18-20
F1-6,8-12	<ul style="list-style-type: none"> <li>• Measure rear axle flange run out and shaft endplay; determine needed repairs.</li> </ul>	C5-7,15,16

<p>F1,2,5,6,8,12</p> <p>F1-6,8-12</p> <p>F1-6,8-12</p> <p>F1-6,8-12</p> <p>F1-6,8-12</p> <p>F1-6,8-12</p>	<p><b>Unit 4: Drive Line Construction, Operation, Diagnosis and Repair</b>  <b>Unit Objectives:</b>  Upon completion of this unit, students will be able to:</p> <ul style="list-style-type: none"> <li>• Explain the operation and construction of a front and rear wheel drive shaft.</li> <li>• Diagnose FWD shaft, CV joint noises and vibration; determine needed repair.</li> <li>• Diagnose RWD shaft, U-joint noises and vibration; determine needed repair.</li> <li>• Inspect or service FWD and RWD shaft yokes, boots, and U- joints or CV joints.</li> <li>• Inspect, service, and replace center support bearings.</li> <li>• Check shaft balance and run-out; determine needed repair.</li> </ul>	<p>C5-7,15</p> <p>C5-7,15,16, 18-20</p> <p>C5-7,15,16, 18-20</p> <p>C5-7,15,16, 18-20</p> <p>C5-7,15,16, 18-20</p> <p>C5-7,15,16, 18-20</p>
<p>F1-6,8-12</p> <p>F1-6,8-12</p> <p>F1-6,8-12</p> <p>F1-6,8-12</p> <p>F1-6,8-12</p>	<p><b>Unit 5: Four-Wheel Drive Component Diagnosis and Repair</b>  <b>Unit Objectives:</b>  Upon completion of this unit, students will be able to:</p> <ul style="list-style-type: none"> <li>• Diagnose four-wheel drive assembly problems; determine needed repairs.</li> <li>• Inspect, adjust, and repair transfer case.</li> <li>• Inspect, service, and replace front-drive shafts and universal joints.</li> <li>• Inspect, service, and replace front-drive axle knuckles and shafts.</li> <li>• Inspect, service, and replace front-wheel bearings and locking hubs.</li> <li>• Inspect front axle seals and vents.</li> </ul>	<p>C5-7,15,16, 18-20</p>

**AUMT 2413**  
**Automotive Drive Train & Axles**  
**Assignment and Exam Schedule**

Unit 1 August 29<sup>th</sup> - Sept.14<sup>th</sup> **Power Train and Clutch's** September 7th Labor Day Holiday  
Assignment: In textbook read Chapters 6, 121, & page 149 - 151. Be prepared to discuss in class.  
Participate in all lab projects. Complete the chapter quiz at the end of each chapters, 6, 121, and turn in on due date, other written and in class assignments will be assigned throughout the unit, maybe even online.

**Unit 1 Assignment Due:** September 14<sup>th</sup>

**Unit 1 Written Exam:** September 14<sup>th</sup> (possibly on-line)

**Unit 1 Skills Exam** September 14<sup>th</sup>

Unit 2 September 19<sup>th</sup> – October 5<sup>th</sup> **Manual Transmission Diagnosis & Repair**

Assignment: In textbook read Chapter 122 In text, and be prepared to discuss in class.  
Participate in all lab projects. Complete the chapter quiz at the end of Chapter 122, other written and in class assignments will be assigned throughout the unit, maybe even online.

**Unit 2 Assignment Due:** October 5<sup>th</sup>

**Unit 2 Written Exam:** October 5<sup>th</sup> (possibly on-line)

**Unit 2 Skills Exam** October 5<sup>th</sup>

Unit 3 October 10<sup>th</sup> – October 26<sup>th</sup> **Differentials and Drive Axles**

Assignment: Read Chapter 125. In text, and be prepared to discuss in class. Participate in all lab projects. Complete the chapter quiz at the end of chapter 125, other written and in class assignments will be assigned throughout the unit, maybe even online  
You also need to have a thorough understanding of the terms: bearing preload, gear tooth contact pattern, and backlash.

**Unit 3 Assignment Due:** October 26<sup>th</sup>

**Unit 3 Written Exam** October 26<sup>th</sup> (possibly on-line)

**Unit 3 Skills Exam** October 26<sup>th</sup>

**Unit 4** October 31<sup>st</sup> – November 16<sup>th</sup> **Drive line, Operation, Diagnosis and Repair**

Assignment: Read Chapters 123,124 In text, and be prepared to discuss in class. Participate in all lab projects. Complete the chapter quiz at the end of chapter 123,124, other written and in class assignments will be assigned throughout the unit, maybe even online.

**Unit 4 Assignment Due:** November 16<sup>th</sup>

**Unit 4 Written Exam:** November 16<sup>th</sup> (possibly on-line)

**Unit 4 Skills Exam** November 16<sup>th</sup>

**Thanksgiving Holiday November 22nd – 23rd**

Unit 5 November 21<sup>st</sup> – December 7<sup>th</sup> **Four-Wheel Drive Component Diagnosis and Repair**

Unit 5 Assignment: **There is no written assignment with this unit.**

Assignment: Read Chapter 126 in the Manual. Complete the chapter quiz at the end of chapter 126. All material will be covered in the lab where applicable.

**The Final Exam is scheduled for Dec. 12<sup>th</sup> at 6:30pm it will be a comprehensive written exam. Please allow yourself adequate study time.**

## 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 members 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.

## 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.