

COURSE SYLLABUS

Course Title: AUMT 2317-271 Engine Performance Analysis I (3:1:8)
Semester/Year: Fall 2019
Instructor: Mr. Marc Wischkaemper
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Office Hours: Check posted hours after classes begin or by appointment.

SOUTH PLAINS COLLEGE IMPROVES EACH STUDENTS LIFE

GENERAL COURSE INFORMATION

- A. **Course Description: (3:1:8)** – Prerequisite: AUMT 1407. Theory, operation, diagnosis, and repair of basic engine dynamics, ignition systems, and fuel delivery systems. Use of basic engine performance diagnostic equipment. May be taught manufacturer specific.
- B. **Course Goals/Objectives** Theory, operation, diagnosis and repair of basic engine dynamics, ignition systems, and fuel delivery systems. Use of basic engine performance diagnostic equipment. May be taught manufacturer specific. Utilizing appropriate safety procedures, the student will explain engine dynamics; diagnose and repair ignition systems and fuel delivery systems; and demonstrate the proper use of basic performance diagnostic equipment
- C. **Course Competencies:** A = 100-90 B = 89-80 C = 79-70 F = 69 or below.
A grade of a C or higher is required in AUMT 2417 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): 2, 3, 4, 6, 8, 9, 10, and 12.
Competencies (C): 5, 7, 8, 15, 16, 17, 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 #'s AUMT 1366, or AUMT 2366). In addition the student will also be prepared to take the ASE Student Certification test for Engine Performance.

SPECIFIC COURSE/INSTRUCTOR REQUIREMENTS

Textbook & Other Required Materials:

James D. Halderman, Automotive Technology – Principles, Diagnosis, and Service
5th edition, Pearson Publishers, 2016 (with on-line curriculum)
Pen or pencil and paper for note taking and assignments
Clear Safety Glasses

- A. **Attendance Policy:** 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, **without notice. Excessive absences means 4 (four) or more absences for any reason, there are no excused absences. Upon the 5th absence, each student will lose 10 points off of their current GPA, the 6th absence an additional 10 points, and the 7th absence an additional 10 points. Excessive absences cause you to miss key points of a class and show you are not reliable/dependable for employment. Two (2) tardies will count as one absence. Leaving class without notifying your instructor is considered an absence, regardless of the time you left.**

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.

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.

- C. **Assignment Policy:** All assignments are due at the beginning of class on the due date unless otherwise stated by your instructor. 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 may be no makeup assignments and no late assignments will be accepted.** The dates printed in this syllabus can change. Every effort will be made to inform 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 are mandatory for effective student evaluation. Exams will cover theory and practical skills pertaining to all aspects of material presented. Adequate study time should be set aside for exam reviews. **There may be no makeup exams. All fees owed to South Plains College, including projects, are required to be paid in full before you take your final exam.**

Course Requirement: All students must participate in the Automotive Service Excellence (ASE) industry certification assessment mentioned above.

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 skills tests)

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. **If you're late for a skills test the following will happen; 0 to 5 minutes late = -10pts; more than 5 min. but less than 10 min. late = -20pts; more than 10 min. but less than 15 min. late = -30pts. If you are more than 15 minutes late you will have earned a "0" for the test.**

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.

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. Please turn off all cell phones, pagers, etc. during class. A detailed list of lab/shop guidelines will be distributed to you at the beginning of this class; you are expected to follow all guidelines when in the shop. **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.

Diversity Statement

In this class, the teacher will establish and support an environment that values and nurtures individual and group differences and encourages engagement and interaction. Understanding and respecting multiple experiences and perspectives will serve to challenge and stimulate all of us to learn about others, about the larger world and about ourselves. By promoting diversity and intellectual exchange, we will not only mirror society as it is, but also model society as it should and can be.

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.

- 1 Never leave your personal property unsecured or unattended.
- 2 Look around and be aware of your surroundings when you enter and exit a building.
- 3 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.
- 4 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>In case of emergency, contact the following numbers, but DO NOT leave a voice mail message. 716-4677 - ATC 716-2923 - Reese Center (mobile 806-893-5705)</p>

Foundation Skills

COURSE OBJECTIVES

Competencies

Foundation Skills	COURSE OBJECTIVES	Competencies
	<p>Unit II: Tune-up and Basic Ignition Systems</p> <p>Unit Objectives: Upon completion of this unit the student will be able to:</p>	
F6,10,12	<ul style="list-style-type: none"> • Discuss the different types of electronic ignition systems. 	C5,15,16,19,20
F6,10,12	<ul style="list-style-type: none"> • Discuss the operation of conventional ignition systems. 	C15,16,19
F6,10,12	<ul style="list-style-type: none"> • Discuss the benefits of high-energy ignition systems. 	C5,15,16,19,20
F6,10,12	<ul style="list-style-type: none"> • Discuss electronic spark timing (EST) 	C5,15
F3,9,10,12	<ul style="list-style-type: none"> • Explain why it is necessary to coat the base of an ignition module with a special silicone compound during installation. 	C5,15
F3,6,10,12	<ul style="list-style-type: none"> • Discuss how distributor advance is controlled on an engine equipped with HEI EST. 	C5,15,17
F8,9,10,12	<ul style="list-style-type: none"> • Test and diagnose starting and drivability problems in electronic ignition systems. 	C5,15,16,18,19,20
F8,9,10,12	<ul style="list-style-type: none"> • Inspect, test, and repair ignition secondary circuits. 	*
F8,9,10,12	<ul style="list-style-type: none"> • Inspect, test, and replace ignition coil. 	*
F8,9,10,12	<ul style="list-style-type: none"> • Inspect, test, and replace electronic ignition triggering devices. 	*
F8,9,10,12	<ul style="list-style-type: none"> • Inspect and test electronic ignition wiring harness. 	*
F8,9,10,12	<ul style="list-style-type: none"> • Inspect, test, and replace electronic ignition control unit. 	*
F8,9,10,12	<ul style="list-style-type: none"> • Test the operation of spark control systems. 	*
F8,9,10,12	<ul style="list-style-type: none"> • Inspect, test, and repair spark control systems. 	*
F3,8,9,10,12	<ul style="list-style-type: none"> • Inspect, test, and repair vacuum components of spark control systems. 	*
F8,9,10,12	<ul style="list-style-type: none"> • Functionally use various types of engine analysis scopes. 	*
F8,9,10,12	<ul style="list-style-type: none"> • Inspect, test, and repair an Electronic Ignition System. 	*

Foundation Skills

COURSE OBJECTIVES

Competencies

Foundation Skills	COURSE OBJECTIVES	Competencies
	<p>Unit III: Basic Fuel Systems Unit Objectives: Upon completion of this unit, the student will be able to:</p>	
F6,9,10,12	<ul style="list-style-type: none"> discuss fuel quality and the affects it has on engine performance. 	C5,7,15,16,
F6,9,10,12	<ul style="list-style-type: none"> discuss fuel tanks, filters, and gas cap functions and repairs. 	18,19,20
F6,9,10,12	<ul style="list-style-type: none"> discuss fuel pump operations and controls. 	*
F3,6,9,10,12	<ul style="list-style-type: none"> discuss injector operation and repairs. 	C5,7,15
F6,8,9,10,12	<ul style="list-style-type: none"> discuss proper techniques for diagnosing drivability problems. 	*
F6,9,10,12	<ul style="list-style-type: none"> discuss why diagnostic performance tests are necessary. 	*
F8,9,10,12	<ul style="list-style-type: none"> diagnose and repair starting and drivability concerns on fuel injected engines. 	C5,17
	<ul style="list-style-type: none"> inspect, test, and replace fuel pump and controls. 	*
F8,9,10,12	<ul style="list-style-type: none"> remove and replace throttle body and adjust linkage. 	C5,15,18
F10	<ul style="list-style-type: none"> test the operation of idle speed controls 	C5,8,15,18,19,
F3,10	<ul style="list-style-type: none"> inspect, test, and replace electrical and vacuum components of decell controls. 	20
F8,9,10,12	<ul style="list-style-type: none"> discuss intake manifold heat controls. 	C5,15,16,18,
F6,10	<ul style="list-style-type: none"> discuss fuel vapors control system. 	19,20
F6,10	<ul style="list-style-type: none"> inspect, test, and replace air temperature controls. 	C5,7,15
F8,9,10,12	<ul style="list-style-type: none"> inspect, test, and repair manifold heat controls. 	C5,7,15
F8,9,10,12	<ul style="list-style-type: none"> inspect, test, and repair fuel vapor control system. 	C5,15,16,18,
F8,9,10,12	<ul style="list-style-type: none"> inspect fuel tank and cap. 	19,20
F8,9,10,12	<ul style="list-style-type: none"> inspect and replace a fuel filter. 	*
F8,9,10,12	<ul style="list-style-type: none"> inspect and replace fuel lines and hoses. 	C5,15
F3,8,9,10,12		*
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Foundation Skills

COURSE OBJECTIVES

Competencies

Foundation Skills	COURSE OBJECTIVES	Competencies
	<p>Unit IV: Basic Electronic Engine Management – OBD</p> <p>Unit Objectives: Upon completion of this unit, the student will be able to:</p>	
F4,10	<ul style="list-style-type: none"> compare digital and analog signals. 	C5,8,15
F4,6,10	<ul style="list-style-type: none"> discuss how reference voltage is developed and where it originates. 	C5,8,15
F1,10	<ul style="list-style-type: none"> list and discuss the 3 types of computer memory. 	C5,8,15
F6,8,9,10,12	<ul style="list-style-type: none"> discuss how scanners can be used to diagnose performance problems. 	C5,8,15,16,18,19,20
F6,8,9,10,12	<ul style="list-style-type: none"> discuss how poor engine performance can affect outputs controlled by the computer. 	*
F1,6,10	<ul style="list-style-type: none"> list and discuss the various input devices found on computer controlled engines. 	C5,8,15
F6,10	<ul style="list-style-type: none"> identify and discuss the various computer controlled output devices. 	C5,8,15
F4,8,9,10,12	<ul style="list-style-type: none"> perform diagnostic procedures on vehicle computer systems. 	*
F8,9,10,12	<ul style="list-style-type: none"> inspect, test, adjust, and replace electronic engine controls. 	*
F3,8,9,10,12	<ul style="list-style-type: none"> test and replace an oxygen sensor. 	*
F3,8,9,10,12	<ul style="list-style-type: none"> inspect, test, adjust, and replace fuel injectors 	*
F3,8,9,10,12	<ul style="list-style-type: none"> inspect and test throttle position sensor. 	*
F8,9,10,12	<ul style="list-style-type: none"> inspect and test coolant temperature sensor. 	*
F6,10	<ul style="list-style-type: none"> inspect and test air flow meter. 	*
F6,10	<ul style="list-style-type: none"> discuss the basic functions controlled in closed loop operations. 	*
F6,8,9,10,12	<ul style="list-style-type: none"> discuss input and output sensor operation. 	*
F6,10	<ul style="list-style-type: none"> discuss how back up modes operate. 	C5,8,15
F8,9,10,12	<ul style="list-style-type: none"> discuss the advantage of port fuel injection. 	C5,8,15,17
F8,9,10,12	<ul style="list-style-type: none"> use trouble codes to pinpoint the locations of problems on computerized engines. 	*
F8,9,10,12	<ul style="list-style-type: none"> discuss how problems can be located when no trouble codes are stored in memory. 	*
F3,9,10,	<ul style="list-style-type: none"> diagnose and repair starting and drivability concerns on computerized engines. 	*
F4,8,9,10,12	<ul style="list-style-type: none"> adjust idle speed and fuel mixture on computerized fuel control systems. 	C5,8,15,16
F4,8,9,10,12	<ul style="list-style-type: none"> inspect, test, clean, and replace computerized fuel controls. 	C5,8,15,16
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Foundation Skills

COURSE OBJECTIVES

Competencies

Foundation Skills	COURSE OBJECTIVES	Competencies
	<p>Unit V: Emission Control & Hybrid Vehicle Intro.</p> <p>Unit Objectives: Upon completion of this unit the student will be able to:</p>	
F6,8,9,10,12	discuss PCV operations and need of maintenance of PCV systems.	C5,15,16
F6,10	discuss how an air injection system operates.	C5,15
F6,10	discuss the components of an air injection system.	C5,15
F6,10	discuss inlet air temperature controls.	C5,15
F6,10	discuss how NOx emissions are reduced by the EGR valve.	C5,15,16
F6,10	discuss EGR valve operations.	C5,15
F6,8,9,10,12	discuss catalytic converter operation.	*
F6,8,9,10,12	discuss causes of exhaust problems and needed repairs.	*
F6,10	discuss causes of HC, CO, CO2 and NOx.	C5,15
F8,9,10,12	diagnose engine control problems with infrared exhaust analyzer.	*
F8,9,10,12	inspect, test, and replace PCV and PCV controls.	*
F8,9,10,12	inspect, test, and service a pump type air injection system.	*
F8,9,10,12	inspect, test, and replace air injection pump hoses and check valves.	*
F8,9,10,12	inspect and replace air injection pump electrical controls.	*
F8,9,10,12	inspect, test, and replace EGR valve.	*
F8,9,10,12	inspect, test, and repair EGR vacuum and pressure controls and hoses.	*
F8,9,10,12	Perform proper handling techniques for batteries, tools & equipment associated with a Hybrid vehicle.	*
F8,9,10,12	Perform a jump assist procedure on a Hybrid vehicle. (2-mode)	*
F8,9,10,12	Use trouble codes to pinpoint the locations of problems on a Hybrid Vehicle.	C5,8,15,17

AUMT 2417

Performance I Assignment and Exam Schedule

Unit I: Engine Operation, and Basic Engine Diagnosis August 26th - September 11th

Log on to the on-line curriculum to view any assignments for Unit 1. In your textbook READ Chapters 18, 21, 26, 88, and pages 965 to 975. **Complete the chapters quiz questions for chapters 18, 21 & 26 and turn in on the due date below.** Take notes on all lectures, read any handouts given and be prepared to discuss this material in each class. Actively participate in all assigned lab activities/projects, this includes job sheets.

Unit I Assignment: September 11th

Unit I Skills exam: September 11th

Unit 1 Written Exam: September 11th

Unit II: Tune-up and Basic Ignition Systems September 16th –October 2nd

Log on to the on-line curriculum to view any assignments for Unit 2. In your textbook read chapters 69 & 70. **Complete the chapters quiz questions for Ch's 69 & 70 and turn in on the due date below.** Take notes on all lectures, read any handouts given and be prepared to discuss this material in each class. Actively participate in all assigned lab activities/projects, this includes job sheets.

Unit II Assignment: October 2nd

Unit II Skills exam: October 2nd

Unit II Written Exam: October 2nd

Unit III: Basic Fuel Systems October 7th – October 23rd

Log on to the on-line curriculum to view any assignments for Unit 3. In your textbook read chapters 66, 77, 78 & 81. **Complete the chapters quiz questions for chapters 66,77,78,81 and turn in on the due date below.** Take notes on all lectures, read any handouts given and be prepared to discuss this material in each class. Actively participate in all assigned lab activities/projects, this includes job sheets.

Unit III Assignment: October 23rd

Unit III Skills exam: October 23rd

Unit III Written Exam: October 23rd

Unit IV: Basic Electronic Engine Management – OBD October 28th – November 13th

Log on to and the on-line curriculum to view any assignments for Unit 4. In your textbook review Chapter 88 pp. 965 – 975 and read Chapters 71, 72, 73, 74, 75, & 76. **Complete the chapters quiz questions for chapters 71, 72, 73, 74, 75, & 76 and turn in on the due date below.** Take notes on all lectures, read any handouts given and be prepared to discuss this material in each class. Actively participate in all assigned lab activities/projects, this includes job sheets.

Unit IV Assignment: Nov 13th

Unit IV Skills exam: Nov 13th

Unit IV Written Exam: November 13th

THANKSGIVING BREAK --- November 27th – 29th

Unit V: Emissions Control & Hybrid Vehicle Intro. December 2nd – December 4th

Log on to the on-line curriculum to view any assignments for Unit 5. In your textbook read Chapters 82, 85, & 86. **Complete the chapters quiz questions for chapters 82, 85, & 86 and turn in on the due date below.** Take notes on all lectures, read any handouts given and be prepared to discuss this material in each class. Actively participate in all assigned lab activities/projects, this includes job sheets.

Unit V Assignment due: December 4th

There will be no written test for Unit V - this information will be covered on the final exam.

Final Exam: December 9th@ 1:30PM

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 polite-ness 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.