DOCUMENT RESUME

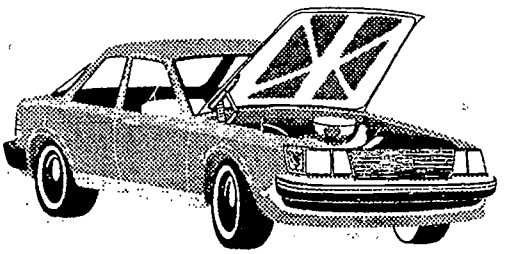
ED 397 314 CE 072 199

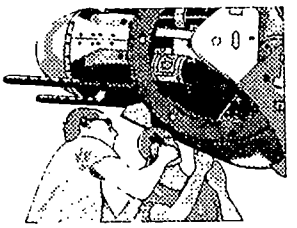
TITLE	Mississippi Curriculum Framework for Automotive Machinist (Program CIP: 47.0690--Auto Machinist). Postsecondary Programs.
INSTITUTION	Mississippi Research and Curriculum Unit for Vocational and Technical Education, State College.
SPONS AGENCY	Mississippi State Dept. of Education, Jackson. Office of Vocational and Technical Education.
PUB DATE	30 Jul 96
NOTE	46p.; For related documents, see CE 072 162-231.
PUB TYPE	Guides - Classroom Use - Teaching Guides (For Teacher) (052)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Auto Body Repairers; Auto Mechanics; Behavioral Objectives; Community Colleges; Competence; *Competency Based Education; Core Curriculum; Educational Equipment; Equipment; Hand Tools; Leadership; Machine Tools; *Machinists; Metal Working; Motor Vehicles; State Curriculum Guides; Statewide Planning; Technical Institutes; Two Year Colleges
IDENTIFIERS	Mississippi

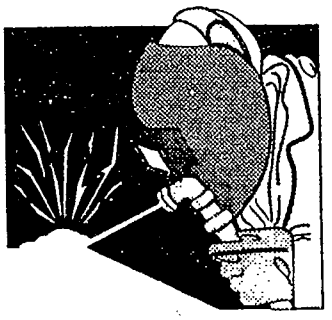
ABSTRACT

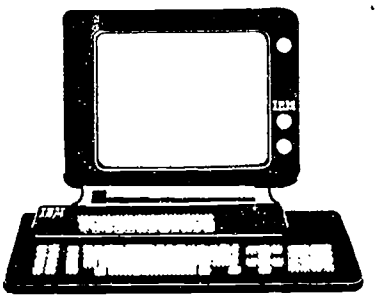
This document, which is intended for use by community and junior colleges throughout Mississippi, contains curriculum frameworks for the course sequences in the automotive machinist programs cluster. Presented in the introductory section are a description of the program and suggested course sequence. Section I lists baseline competencies, and section II consists of outlines for each of the following courses in the sequence: fundamentals for automotive machinists; cylinder head service; cylinder block service; engine assembly and testing; special problem in automotive machinist; work-based learning in automotive machinist; parts and labor; advanced crankshaft balance and grinding; and brake rotor and drum machining. Each course outline contains some/all of the following: course name and abbreviation; course classification; course description; prerequisites; and competencies and suggested objectives. Recommended tools and equipment are listed in section III. Appended are lists of related academic topics and workplace skills for the 21st century and student competency profiles for both courses. (KC)

Mississippi Curriculum Framework for Automotive Machinist









Postsecondary Vocational and Technical Education 1996

July 30, 1996

MISSISSIPPI

CURRICULUM FRAMEWORK

FOR

AUTOMOTIVE MACHINIST

(PROGRAM CIP: 47.0690 – AUTO MACHINIST)

POSTSECONDARY PROGRAMS

1996

July 30, 1996

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Published by the:

Office of Vocational and Technical Education
Mississippi Department of Education
Jackson, Mississippi

Research and Curriculum Unit for Vocational and Technical Education
College of Education
Mississippi State University
Mississippi State, Mississippi

1996

FOREWORD

In order to survive in today's global economy, businesses and industries have had to adopt new practices and procedures. Total quality management, statistical process control, participatory management, and other concepts of high performance work organizations are practices by which successful companies survive. Employers now expect their employees to be able to read, write, and communicate effectively; solve problems and make decisions; and interact with the technologies that are prevalent in today's workplace. Vocational-technical education programs must also adopt these practices in order to provide graduates who can enter and advance in the changing work world.

The curriculum framework in this document reflects these changes in the workplace and a number of other factors that impact on local vocational-technical programs. Federal and state legislation calls for articulation between high school and community college programs, integration of academic and vocational skills, and the development of sequential courses of study that provide students with the optimum educational path for achieving successful employment. National skills standards, developed by industry groups and sponsored by the U. S. Departments of Education and Labor, provide vocational educators with the expectations of employers across the United States. All of these factors are reflected in the framework found in this document.

Each postsecondary program of instruction consists of a program description and a suggested sequence of courses which focus on the development of occupational competencies. Each vocational-technical course in this sequence has been written using a common format which includes the following components:

- Course Name - A common name that will be used by all community/junior colleges in reporting students.

- Course Abbreviation - A common abbreviation that will be used by all community/junior colleges in reporting students.

- Classification - Courses may be classified as:
  - Vocational-technical core - A required vocational-technical course for all students.
  - Vocational-technical elective - An elective vocational-technical course.
  - Related academic course - An academic course which provides academic skills and knowledge directly related to the program area.
  - Academic core - An academic course which is required as part of the requirements for an Associate degree.

- Description - A short narrative which includes the major purpose(s) of the course and the recommended number of hours of lecture and laboratory activities to be conducted each week during a regular semester.

- Prerequisites - A listing of any prerequisite courses that must be taken prior to or on enrollment in the course.

- Competencies and Suggested Objectives - A listing of the competencies (major concepts and performances) and of the suggested student objectives that will enable students to demonstrate mastery of these competencies.

The following guidelines were used in developing the program(s) in this document and should be considered in compiling and revising course syllabi and daily lesson plans at the local level:

- The content of the courses in this document reflects approximately 75 percent of the time allocated to each course. For example, in a four semester hour course consisting of 30 hours lecture and 120 hours of laboratory activities, approximately 22 hours of lecture and 90 hours of lab should be taken by the competencies and suggested objectives identified in the course framework. The remaining 25 percent of each course should be developed at the local district level and may reflect:
  - Additional competencies and objectives within the course related to topics not found in the State framework, including activities related to specific needs of industries in the community college district.
  - Activities which develop a higher level of mastery on the existing competencies and suggested objectives.
  - Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed/revised.
  - Activities which implement components of the Mississippi Tech Prep initiative, including integration of academic and vocational-technical skills and coursework, school-to-career transition activities, and articulation of secondary and postsecondary vocational-technical programs.
  - Individualized learning activities, including worksite learning activities, to better prepare individuals in the courses for their chosen occupational area.

- Sequencing of the course within a program is left to the discretion of the local district. Naturally, foundation courses related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other courses related to specific skill areas and related academics, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors.

- Programs that offer an Associate of Applied Science degree must include a minimum 15 semester credit hour academic core. Specific courses to be taken within this core are to be determined by the local district. Minimum academic core courses are as follows:
  - 3 semester credit hours Math/Science Elective
  - 3 semester credit hours Written Communications Elective
  - 3 semester credit hours Oral Communications Elective
  - 3 semester credit hours Humanities/Fine Arts Elective
  - 3 semester credit hours Social/Behavioral Science Elective

  It is recommended that courses in the academic core be spaced out over the entire length of the program, so that students complete some academic ar vocational-technical courses each semester. Each community/junior college has the discretion to select the actual courses that are required to meet this academic core requirement.

- In instances where secondary programs are directly related to community and junior college programs, competencies and suggested objectives from the high school programs are listed as Baseline Competencies. These competencies and objectives reflect skills and knowledge that are directly related to the community and junior college vocational-technical program. In adopting the curriculum framework, each community and junior college is asked to give assurances that:
  - students who can demonstrate mastery of the Baseline Competencies do not receive duplicate instruction, and
  - students who cannot demonstrate mastery of this content will be given the opportunity to do so.

- The roles of the Baseline Competencies are to:
  - Assist community/junior college personnel in developing articulation agreements with high schools, and
  - Ensure that all community and junior college courses provide a higher level of instruction than their secondary counterparts

- The Baseline Competencies may be taught as special "Introduction" courses for 3-6 semester hours of institutional credit which will not count toward Associate degree requirements. Community and junior colleges may choose to integrate the Baseline Competencies into ongoing courses in lieu of offering the "Introduction" courses or may offer the competencies through special projects or individualized instruction methods.

- Technical elective courses have been included to allow community colleges and students to customize programs to meet the needs of industries and employers in their area.

ACKNOWLEDGEMENTS

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July 30, 1996

PROGRAM DESCRIPTION

AUTOMOTIVE MACHINIST

The Automotive Machinist Program provides instruction in the use of precision measuring instruments, hand tools, machines, and equipment. Covered are types and uses of hand, mechanical, power, and hydraulic tools, along with types of fluids, cutting oils, and coolants. Disassembly and inspection of automotive engines, resurfacing brake drums and rotors, basic engine balancing, and cylinder head rebuilding are included. Students receive instruction and practice in cylinder boring and submerged arc welding of crankshafts. The operations of the drill press and crankshaft grinder, along with a general knowledge of the milling machine, connecting rod rebuilding, and engine assembly, are also covered.

The Automotive Machinist Program is designed for a period of twelve months. Exit points are provided to allow for employment and ASE certification after the completion of Cylinder Head Service (ASE-Upper Engine), Cylinder Block Service (ASE-Lower Engine), and Engine Assembly and Testing (ASE-Engine Assembly). Successful graduates are awarded an Automotive Machinist Certificate and may be employed as auto machinists in auto machine shops, auto parts concerns, automotive dealerships, mechanics shops, and automotive engine manufacturing firms.

AUTOMOTIVE MACHINIST

SUGGESTED COURSE SEQUENCE*

Baseline Competencies for Postsecondary Automotive Machinist**

FIRST YEAR

6 sch	Fundamentals for Automotive Machinists (AUV 1116)	6 sch	Cylinder Block Service (AUV 1316)
6 sch	Cylinder Head Service (AUV 1216)	6 sch	Engine Assembly and Testing (AUV 1416)
1-3 sch	Special Problem in Automotive Machinist [AUV 191(1-3)]	3-6 sch	Vocational-Technical Electives†
		1-6 sch	Work-Based Learning in Automotive Machinist [AUV 192(1-6)]
13-15 sch		16-24 sch	

* Students who lack entry level skills in math, English, science, etc., will be provided related studies.

** Baseline competencies are taken from the high school Automotive Mechanics program. Students who can document mastery of these competencies should not receive duplicate instruction. Students who cannot demonstrate mastery will be required to do so.

† VOCATIONAL-TECHNICAL ELECTIVES
Parts and Labor (AUV 1513)
Advanced Crankshaft Balance and Grinding (AUV 1613)
Brake Rotor and Drum Machining (AUV 1713)

SECTION I:

BASELINE COMPETENCIES

BASELINE COMPETENCIES FOR AUTOMOTIVE MACHINIST

The following competencies and suggested objectives are taken from the publication *Mississippi Curriculum Framework for Automotive Mechanics*. These competencies and objectives represent the baseline which was used to develop the community/junior college Automotive Machinist courses. Students enrolled in postsecondary courses should either (1) have documented mastery of these competencies, or (2) be provided with these competencies before studying the advanced competencies in the Automotive Machinist program.

Baseline competencies may be integrated into existing courses in the curriculum or taught as special "Introduction" courses. The "Introduction" courses may be taught for up to six semester hours of institutional credit and may be divided into two courses. If the Baseline Competencies are to be taught as "Introduction" courses, each course should be at least 3 credit hours. The following course number(s) and description should be used:

Course Name(s): Introduction to Automotive Machinist, Introduction to Automotive Machinist I, or Introduction to Automotive Machinist II

Course Abbreviation(s): AUV 100(3-6), AUV 1013, AUV 1023

Classification: Vocational-Technical Core

Description: These courses contain the baseline competencies and suggested objectives from the high school Automotive Mechanics curriculum which directly relate to the community college Automotive Machinist program. The courses are designed for students entering the community college who have had no previous training or documented experience in the field. (3-6 semester hours based upon existing skills for each student. May be divided into 2 courses for a maximum total of 6 hours of institutional credit.)

Competencies and Suggested Objectives:

1. Demonstrate safety procedures used in automotive service.
   a. Apply safety rules for personal and general shop safety including eye (State Eye Safety Law provisions), ear, and body protection; general rules of shop conduct; and the use of safety color coding in automotive shops.
   b. Apply general safety rules for tool and shop equipment use including use of hand tools, air and electric power tools, and other shop equipment.
   c. Apply general safety rules associated with working on various vehicle systems.

d. Apply rules and procedures associated with fire safety including procedures for handling and storing flammable liquids and proper use of fire fighting devices.

Related Academic Topics (See Appendix A): C2, C4, S5, S6, S8
Workplace Skills (See Appendix B): WP5

2. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.
   a. Recognize signal words and symbols that indicate severity of a hazard.
   b. Describe methods for reducing hazardous waste.
   c. Describe procedures for storing hazardous waste.
   d. Interpret data found on a hazardous material safety data sheet.
   e. Describe general safety procedures for first aid and cleanup to follow in case of an accident involving hazardous materials.
   f. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.

   Related Academic Topics (See Appendix A): C1, C2, C4, S5, S8
   Workplace Skills (See Appendix B): WP2, WP3, WP4, WP5, WP6
3. Demonstrate safe and proper use and storage of tools and equipment in an automotive shop.
   a. Identify and demonstrate the safe and proper use of common hand tools including wrenches, sockets, pliers, screwdrivers, striking tools, etc.
   b. Identify and demonstrate the safe and proper use of lifting and hoisting equipment.
   c. Identify and demonstrate the safe and proper use of cleaning equipment.
   d. Identify and demonstrate the safe and proper use of power equipment including impact wrenches, drills, grinders, and presses.
   e. Organize and maintain a systematic storage system for hand and power tools.

   Related Academic Topics (See Appendix A): C2, C4, S8
   Workplace Skills (See Appendix B): WP1, WP5, WP6
4. Locate and apply service specifications and information.
   a. Locate service specifications and information, using both print and computerized service information references.
   b. Interpret and apply information to a specific job on a specific vehicle.
   c. Locate and interpret vehicle and major component identification numbers (VIN, certification, and calibration labels).

   Related Academic Topics (See Appendix A): C1, C4, M1, M4, S8
   Workplace Skills (See Appendix B): WP2, WP5, WP6
5. Demonstrate measurement practices used in automotive service.
   a. Measure the length of an object using a rule to the nearest 1/16th of an inch and 1 millimeter.
   b. Measure the inside diameter, outside diameter, and/or depth to the nearest .001 of an inch and nearest .1 millimeter, using precision measuring instruments (micrometers, calipers, and dial indicators).

Related Academic Topics (See Appendix A): M4, S8
Workplace Skills (See Appendix B): WP2, WP5

6. Identify common fasteners and describe their use.
   a. Identify the different types of bolts, nuts, and washers and describe their appropriate uses.
   b. Identify bolts by grade, diameter, length, and thread pitch.
   c. Identify different glues and sealants used in automotive service and describe their appropriate use.
   d. Restore internal and external threads.

   Related Academic Topics (See Appendix A): C2, M1, M5, S6
   Workplace Skills (See Appendix B): WP2, WP5, WP6
7. Identify and describe the major systems and components of an automobile.
   a. Describe the operation of a four-stroke cycle engine.

   Related Academic Topics (See Appendix A): C1, C2, C4, S6
   Workplace Skills (See Appendix B): WP2, WP4, WP5
8. Inspect and evaluate engine mechanical condition.
   a. Describe common parts failures and wear points in a four cycle engine.

   Related Academic Topics (See Appendix A): C2, C6, M4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP4, WP5
9. Perform basic service on an engine.
   a. Verify correct camshaft timing; determine needed action.
   b. Grind a valve and valve seat to correct specifications.
   c. Adjust valves on engines with mechanical or hydraulic lifters.

   Related Academic Topics (See Appendix A): C1, C2, M4, S6
   Workplace Skills (See Appendix B): WP2, WP4, WP5

SECTION II:

CURRICULUM GUIDE

FOR

AUTOMOTIVE MACHINIST

Course Name: Fundamentals for Automotive Machinists

Course Abbreviation: AUV 1116

Classification: Vocational-Technical Core

Description: This course includes the study and practice of personal hand tools and shop safety; study and practice of measuring; types of calipers, micrometers, and gauges; types and uses of hand tools, mechanical tools, power, and hydraulic tools, fluids, and coolants; and identification of materials and metals. Included is the development of employment skills useful to the Automotive Machining occupations. (6 sch: 2 hr. lecture, 8 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Explain safety procedures used in automotive machinist industry.
   a. Describe school policies and shop procedures.
   b. Explain and apply safety rules for personal safety including eye, ear, and body protection.
   c. Explain and apply general shop safety including power and hand tools.
   d. Explain and practice procedures for handling, storing, and disposing of hazardous materials.
   e. Describe The-Right-To-Know law.
   f. Describe data available in Material Safety Data Sheets.
   g. Demonstrate machine tool safety.
   h. Explain rules and procedures associated with fire safety and emergencies according to local facility guidelines.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, S5, S8
   Workplace Skills (See Appendix B): WP2, WP6
2. Demonstrate precision measurements using steel rule, machinist rule, calipers, micrometers, and gauges.
   a. Identify selected precision measurement instruments.
   b. Measure the length of an object using a steel rule and a machinist rule to the nearest 1/64th of an inch and 1 millimeter.
   c. Measure the inside diameter, outside diameter, and/or depth to the nearest .0001 of an inch and nearest .1 millimeter, using precision measuring instruments including micrometers, calipers, and dial indicators.

   Related Academic Topics (See Appendix A): C1, C2, C3, M1, M2, M4, S8
   Workplace Skills (See Appendix B): WP2, WP5, WP6

3. Demonstrate safe and proper use and storage of tools and equipment in a machinist shop.
   a. Explain and demonstrate the safe and proper use of wrenches, screwdrivers, pliers, sockets, etc.
   b. Explain and demonstrate the safe and proper use of power tools such as air wrenches, engine hoists, presses, drills, etc.
   c. Explain and demonstrate the safe and proper use of cleaning equipment.
   d. Practice proper storage of all tools and equipment used in a machinist shop.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, M1, M2, S6, S8

   Workplace Skills (See Appendix B): WP2, WP5, WP6
4. Apply methods of identification and cleaning of engine parts.
   a. Interpret and apply service specifications and information, using both print and computerized service information references.
   b. Interpret and apply information to a specific job.
   c. Appraise the effectiveness of a minimum of two cleaning systems.

   Related Academic Topics: C1, C2, C3, C4, M1

   Workplace Skills: WP2, WP6

Course Name: Cylinder Head Service

Course Abbreviation: AUV 1216

Classification: Vocational-Technical Core

Description: This course includes the rebuilding and cleaning of cylinder heads; valve guide reconditioning; valve seat replacing and installation; refacing seats, surfacing cylinder heads, and assembling a cylinder head. (6 sch: 2 hr. lecture, 8 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Disassemble cylinder head and identify all parts.
   a. Disassemble cylinder head and remove old parts.
   b. Identify head and parts.
   c. Inspect cylinder head and associated parts for cracks.
   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, M1, M3, S6, S8
   Workplace Skills (See Appendix B): WP6
2. Resurface cylinder head to manufacturer's specifications.
   a. Resurface cylinder head to manufacturer's specifications.
   Related Academic Topics (See Appendix A): C1, C2, C3, C4, M1, M3, S6, S8
   Workplace Skills (See Appendix B): WP2
3. Recondition valve seats, valve guides, and valve surfaces to manufacturer's specifications.
   a. Reface and stem valve.
   b. Inspect visually and measure the valve (including stem) for wear.
   c. Install valve seats and guides using a seat and guide machine with proper tooling.
   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, M1, M2, M3, S6, S8
   Workplace Skills (See Appendix B): WP6
4. Complete assembly of the cylinder head according to manufacturer's specifications.
   a. Locate manufacturer's specifications.
   b. Acquire tooling.
   c. Acquire proper sealers.
   d. Gather necessary assembly parts.

e. Assemble the cylinder head.

Related Academic Topics (See Appendix A): C1, C2, C3, C4, M1, M2, M4, M5, M7, S6, S8

Workplace Skills (See Appendix B): WP6

Course Name: Cylinder Block Service

Course Abbreviation: AUV 1316

Classification: Vocational-Technical Core

Description: This course includes the study of cylinder boring, crankshaft grinding and welding, rod reconditioning, and engine balancing. (6 sch: 2 hr. lecture, 8 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Bore and hone cylinders.
   a. Bore and hone cylinders to manufacturer's specifications.
   b. Install cylinder sleeve and finish to manufacturer's specifications.
   Related Academic Topics (See Appendix A): C1, C2, C3, C4, M1, M2, M4, M5, M7, S6, S8
   Workplace Skills (See Appendix B: WP2, WP6
2. Set up and grind a crankshaft to manufacturer's specifications.
   a. Inspect a crankshaft for straightness and cracks and a camshaft for cracks.
   b. Measure a crankshaft and camshaft for manufacturer's specifications.
   c. Describe hazards of industrial gasses used in welding.
   d. Apply required safety practices associated with welding safety including shielding of argon and other gasses.
   e. Prepare/perform buildup of journals if necessary, using submerged arc welding and/or gas tungsten arc welding processes.
   f. Set machine for correct stroke.
   g. Prepare and grind a crankshaft to manufacturer's specifications.
   Related Academic Topics (See Appendix A): C1, C2, C3, C4, M1, M2, M4, M7, S6, S8
   Workplace Skills (See Appendix B): WP2, WP6
3. Resize connecting rods to manufacturer's specifications.
   a. Resize connecting rod bores (both ends) according to manufacturer's specifications.
   b. Check rod for straightening and cracks.
   Related Academic Topics (See Appendix A): C1, C2, C3, C4, M1, M2, M4, M5, M7, S6, S8
   Workplace Skills (See Appendix B): WP2, WP6
4. Demonstrate internal or external engine balancing techniques.
   a. Weigh and balance connecting rod.
   b. Weigh and balance piston assembly.

c. Spin and balance crankshaft.

Related Academic Topics (See Appendix A): C1, C2, C3, C4, M1, M2, M4, M5, M7, S6, S8

Workplace Skills (See Appendix B): WP2, WP6

Course Name: Engine Assembly and Testing

Course Abbreviation: AUV 1416

Classification: Vocational-Technical Core

Description: This course includes preparation of a block and components for assembly, cam bearings installation, core plugs, seals, cylinder block and components, testing oil pressure; compression; valve adjustment; and checking for leaks and knocks. (6 sch: 2 hr. lecture, 8 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Assemble all engine components and torque to manufacturer's specifications.
   a. Install rod bearings, pistons, and rings according to manufacturer's specifications.
   b. Install cam bearings and camshaft in engine block.
   c. Install oil seals, main bearings, and crankshaft in engine block according to manufacturer's specifications.
   d. Install timing components according to manufacturer's specifications.
   e. Install cylinder heads according to manufacturer's specifications.
   f. Test oil pressure, valve lash, and cylinder compression according to manufacturer's specifications.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, M1, M2, M3, M5, M7, S6, S8
   Workplace Skills (See Appendix B): WP2, WP6

Course Name: Special Problem in Automotive Machinist

Course Abbreviation: AUV 191(1-3)

Classification: Vocational-Technical Core

Description: A course to provide students with an opportunity to utilize skills and knowledge gained in other Automotive Machinist courses. The instructor and student work closely together to select a topic and establish criteria for completion of the project. (1-3 sch: 2-6 hr. lab)

Pre/Corequisites: First semester Automotive Machinist courses

Competencies and Suggested Objectives:

1. Prepare a written agreement.
   a. Compile a written training agreement in cooperation with the instructor and student which details work schedule and specific tasks/skills to be mastered in the program.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6
   Workplace Skills (See Appendix B): WP1, WP2, WP3, WP6
2. Prepare a written report of activities.
   a. Compile a daily log of activities and tasks.
   b. Submit weekly reports to the instructor summarizing activities and tasks completed.
   c. Submit a final report of activities and experiences.

   Related Academic Topics (See Appendix A): C1, C2, C4, C6
   Workplace Skills (See Appendix B): WP1, WP2, WP6
3. Follow written guidelines for special problems.
   a. Complete all required activities in the training agreement.
   b. Adhere to all written and oral instructions for the special problem.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, M7, S8
   Workplace Skills (See Appendix B): WP1, WP2, WP3, WP4, WP5, WP6

Course Name: Work-Based Learning in Automotive Machinist

Course Abbreviation: AUV 192(1-6)

Classification: Vocational-Technical Core

Description: This course is a cooperative program between industry and education and is designed to integrate the student's technical studies with industrial experience. Variable credit is awarded on the basis of one semester hour per 45 industrial contact hours. (1-6 sch: 3-18 hr. externship)

Pre/Corequisites: Consent of instructor and the completion of at least one semester of advanced coursework in the Automotive Machinist program.

Competencies and Suggested Objectives:

1. Apply technical skills needed to be a viable member of the work force.
   a. Prepare a description of technical skills to be developed in the work-based learning program.
   b. Develop technical skills needed to be a viable member of the work force.
   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP1
2. Apply skills developed in other program area courses.
   a. Perform skills developed in other program area courses in the work-based learning program.
   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP5, WP6
3. Apply human relationship skills.
   a. Use pro-active human relationship skills in the work-based learning program.
   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP3
4. Apply and practice positive work habits and responsibilities.
   a. Perform assignments to develop positive work habits and responsibilities.
   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP3
5. Work with instructor and employer to develop written occupational objectives to be accomplished.
   a. Perform written occupational objectives in the work-based learning program.
   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP6
6. Assess accomplishment of objectives.
   a. Prepare daily written assessment of accomplishment of objectives.

b. Present weekly written reports to instructor in activities performed and objectives accomplished.

Related Academic Topics (See Appendix A): C5, C6
Workplace Skills (See Appendix B): WP6

7. Utilize a set of written guidelines for the work-based learning program.
   a. Develop and follow a set of written guidelines for the work-based learning program.

Related Academic Topics (See Appendix A): C5, C6
Workplace Skills (See Appendix B): WP6

Course Name: Parts and Labor

Course Abbreviation: AUV 1513

Classification: Vocational-Technical Elective

Description: This course includes training in the use of computerized parts pricing and inventory, labor price guides, the purchasing and recovery of core materials. (3 sch: 1 hr. lecture, 4 hr. lab)

Pre/Corequisites: All second semester Automotive Machinist courses

Competencies and Suggested Objectives:

1. Arrange parts and supplies for inventory and distribution ease.
   a. Utilize card or computer inventory systems to track parts sales.
   b. Combine similar items or parts for ease of distribution.
   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, M1, M7, S8
   Workplace Skills (See Appendix B): WP2, WP4, WP6
2. Organize a core recovery system.
   a. Develop a system for tracking outstanding cores.
   b. Create a system for inventory and pricing of cores and finished products.
   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, M1, M7, S8
   Workplace Skills (See Appendix B): WP2, WP4, WP6

Course Name: Advanced Crankshaft Balance and Grinding

Course Abbreviation: AUV 1613

Classification: Vocational-Technical Elective

Description: This course includes the study of dynamic and couple unbalance, external and internal balancing, static balancing, crankshaft indexing, straightening, and stroking. (3 sch: 1 hr. lecture, 4 hr. lab)

Pre/Corequisites: Cylinder Block Service (AUV 1316)

Competencies and Suggested Objectives:

1. Measure dynamic and couple unbalance.
   a. Calculate the weight change required to correct unbalance.
   b. Determine the position to correct unbalance with minimal weight change.
   Related Academic Topics (See Appendix A): C1, C2, C4, M1, M2, M7, S6, S8
   Workplace Skills (See Appendix B): WP6
2. Measure stroke and index variation of all rod journals.
   a. Correct unequal strokes by grinding and/or welding if necessary.
   b. Correct index run out by grinding and/or welding.
   Related Academic Topics (See Appendix A): C1, C2, C4, M1, M2, M7, S6, S8
   Workplace Skills (See Appendix B): WP6

Course Name: Brake Rotor and Drum Machining

Course Abbreviation: AUV 1713

Classification: Vocational-Technical Elective

Description: This course includes machining of the brake drum and rotor. (3 sch: 1 hr. lecture, 4 hr. lab)

Pre/Corequisites: Fundamentals for Automotive Machinists (AUV 1116)

Competencies and Suggested Objectives:

1. Describe and identify various components of a brake system.
   a. Describe and identify components of a brake system including brake shoes, drums, calipers, wheel bearings, and seals.

   Related Academic Topics (See Appendix A): C1, C2, M1, M4, S6, S8
   Workplace Skills (See Appendix B): WP2
2. Set up brake drum and disk lathe machine.
   a. Select correct adapters, tool bits, and speed.
   b. Machine to manufacturer' specifications.

   Related Academic Topics (See Appendix A): C1, C2, M1, M4, S6, S8
   Workplace Skills (See Appendix B): WP2

SECTION III:

RECOMMENDED TOOLS AND EQUIPMENT

RECOMMENDED TOOLS AND EQUIPMENT FOR AUTOMOTIVE MACHINIST PROGRAMS

CAPITAL EQUIPMENT

1. Tool Set, General Mechanic, 150 pc. (1 per 4 students)
2. Storage cabinet, fire-proof (1 per program)
3. Air Compressor, minimum 5 HP, 200 gallon tank (1 per program)
4. Cylinder head and block surfacing machine (1 per program)
5. Seat refacer, grinder (1 per 3 students)
6. Seat refacer, cutter (1 per program)
7. Valve refacer (3 per program)
8. Guide Knurler Kit, metric and American (1 of each per program)
9. Bench grinder (2 per program)
10. Magnetic Crack Detection System (1 per program)
11. Gas Tungsten Arc Welder (1 per program)
12. Valve guide and seat machine w/tooling (1 per program)
13. Lathe, 12 inch geared head, w/tooling (1 per program)
14. Mill, vertical w/tooling (1 per program)
15. Boring machine w/tooling (tool bits and holders) (1 per program)
16. Pressure tester system (1 per program)
17. Crankshaft grinder (minimum 2 per program)
18. Crankshaft straightener (1 per program)
19. Honing machine, cylinder (1 per program)
20. Micrometers, metric, inside and outside, 0-6 in. set (2 sets per program)
21. Micrometers, American, inside and outside, 0-6 in. set (2 sets per program)
22. Dial bore gages (1 per program)
23. Cambearing tools, set (2 per program)
24. Submerged arc welder (1 per program)
25. Rod and cap grinder (1 per program)
26. Rod alignment fixture (1 per program)
27. Rod resizing machine w/ complete tooling (2 per program)
28. Piston pin press (1 per program)
29. Run-in machine (1 per program)
30. Chain hoist, electric, ½ ton (4 per program)
31. Rod heater (1 per program)
32. Thermal cleaning system (1 per program)
33. Pressure washer (1 per program)
34. Parts washer, small, tumbler type (2 per program)
35. Glass bead machine (1 per program)
36. Drill press, ½ in. minimum (1 per program)
37. Work benches, 3' x 8', heavy duty w/vise (1 per student)
38. Computer (1 per 4 students)
39. Printer, laser (1 per 2 computers)

NON-CAPITAL EQUIPMENT

1. Drill, ½ in. (1 per 10 students)
2. Dial indicator and gauges (1 per student)
3. Tape Rule, in 1/16th inch increments, 12 ft. (5 per program)
4. Machinist Ruler (1 per student)
5. Calipers (minimum 1 per student)
6. Waste container, fire-proof (5 per program)
7. Spring tester (2 per program)
8. Head stands (1 pair per student)
9. Drill, ⅜ in. (2 per program)
10. Stud remover (1 per program)
11. Valve spring compressor (1 per 3 students)
12. Torque wrenches, inch and foot-pound, ⅜" drive (1 each per 5 students)
13. Torque wrenches, inch and foot-pound, ½" drive (1 each per 5 students)
14. Precision straight edge (2 per program)
15. Non-magnetic crack detection system (1 per program)
16. Valve stem height gage (1 per 4 students, or minimum 2 per program)
17. Oxy fuel gas cutting and welding unit (1 per program)
18. Piston vise (1 per program)
19. Rod vise (2 per program)
20. Pneumatic die grinder (2 per program)
21. Carbide burrs, assorted kit (2 kits per program)
22. Telescoping gages (1 per 4 students)
23. Gage, small hole, set (1 set per 3 students)
24. Hammer, shop (5 per program)
25. Chain hoist, manual, ½ ton (3 per program)
26. Cylinder honer, manual, assorted sizes (4-5 per program)
27. Engine stand (1 per 2 students)
28. Ring compressors (1 per 3 students)
29. Oil seals installation tool (1 per program)
30. Core plug installation tools (1 per program)
31. Oil pressure tester (1 per program)
32. Compression tester (1 per program)
33. Valve adjusting tools, assorted (12-15 per program)
34. Micrometers, American, 2-3 in. (1 per 2 students)
35. Micrometers, American, 0-1 in. (1 per 2 students)
36. Chamfering cone (1 per program)
37. Cabinets, storage, lockable (4 minimum per program)
38. Drill bits, high speed steel, assorted set (1 set per program)
39. Torque plates, assorted set (1 set per program)
40. Paint gun (1 per program)

INSTRUCTIONAL AIDS

1. VCR (1 per program)
2. TV, color monitor, 25" diameter (1 per program)
3. Screen, projection (1 per program)
4. Overhead projector
5. Cabinet, file, 4 drawer, lockable (2 per program)
6. Desk, teacher (1 per program)
7. Chair, teacher (1 per program)

SUGGESTED REFERENCES: (1 each per program)

Hughes, J.G. Automotive Engine Rebuilding. (Latest version). Prentice-Hall, Englewood Cliffs, NJ.
Mitchell's Motor Repair Manual, Domestic
Mitchell's Motor Repair Manual, Foreign
Chilton Repair Manuals
Other Shop and Specifications Manuals
ANSI Safety Course: Safety in Welding, Cutting, and Allied Processes (Z49.1)

VIDEOS: (1 of each per program)

Cylinder Head Rebuilding
Overhead Cam Cylinder Head
Aluminum Cylinder Head Rebuilding
Cylinder Boring
Cylinder Honing
Align Boring
Crankshaft Grinding
Degreeing a Camshaft
Connecting Rod Rebuilding
Lathe and Mill Work
Safety

SOFTWARE:

Prosis Specifications
Automotive Machinist software

APPENDIX A:

RELATED ACADEMIC TOPICS

APPENDIX A

RELATED ACADEMIC TOPICS FOR COMMUNICATIONS

C1 Interpret written material.
C2 Interpret visual materials (maps, charts, graphs, tables, etc.).
C3 Listen, comprehend, and take appropriate actions.
C4 Access, organize, and evaluate information.
C5 Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.
C6 Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.

EXPANDED TOPICS FOR COMMUNICATIONS

TOPIC C1: Interpret written material.

C1.01 Read and follow complex written directions.
C1.02 Recognize common words and meanings associated with a variety of occupations.
C1.03 Adjust reading strategy to purpose and type of reading.
C1.04 Use sections of books and reference sources to obtain information.
C1.05 Compare information from multiple sources and check validity.
C1.06 Interpret items and abbreviations used in multiple forms.
C1.07 Interpret short notes, memos, and letters.
C1.08 Comprehend technical words and concepts.
C1.09 Use various reading techniques depending on purpose for reading.
C1.10 Find, read, understand, and use information from printed matter or electronic sources.

TOPIC C2: Interpret visual materials (maps, charts, graphs, tables, etc.).

C2.01 Use visuals in written and in oral presentations.
C2.02 Recognize visual cues to meaning (layout, typography, etc.).
C2.03 Interpret and apply information using visual materials.

TOPIC C3: Listen, comprehend, and take appropriate action.

C3.01 Identify and evaluate orally-presented messages according to purpose.
C3.02 Recognize barriers to effective listening.
C3.03 Recognize how voice inflection changes meaning.
C3.04 Identify speaker signals requiring a response and respond accordingly.
C3.05 Listen attentively and take accurate notes.
C3.06 Use telephone to receive information.

C3.07 Analyze and distinguish information from formal and informal oral presentations.

TOPIC C4: Access, organize, and evaluate information.

C4.01 Distinguish fact from opinion.
C4.02 Use various print and non-print sources for specialized information.
C4.03 Interpret and distinguish between literal and figurative meaning.
C4.04 Interpret written or oral communication in relation to context and writer's point of view.
C4.05 Use relevant sources to gather information for written or oral communication.

TOPIC C5: Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.

C5.01 Select appropriate words for communication needs.
C5.02 Use reading, writing, listening, and speaking skills to solve problems.
C5.03 Compose inquiries and requests.
C5.04 Write persuasive letters and memos.
C5.05 Edit written reports, letters, memos, and short notes for clarity, correct grammar, and effective sentences.
C5.06 Write logical and understandable statements, phrases, or sentences for filling out forms, for correspondence or reports.
C5.07 Write directions or summaries of processes, mechanisms, events, or concepts.
C5.08 Select and use appropriate formats for presenting reports.
C5.09 Convey information to audiences in writing.
C5.10 Compose technical reports and correspondence that meet accepted standards for written communications.

TOPIC C6: Communicate ideas and information using oral and written forms for a variety of audiences and purposes.

C6.01 Give complex oral instructions.
C6.02 Describe a business or industrial process/mechanism.
C6.03 Participate effectively in group discussions and decision making.
C6.04 Produce effective oral messages utilizing different media.
C6.05 Explore ideas orally with partners.
C6.06 Participate in conversations by volunteering information when appropriate and asking relevant questions when appropriate.
C6.07 Restate or paraphrase a conversation to confirm one's own understanding.
C6.08 Gather and provide information utilizing different media.

C6.09 Prepare and deliver persuasive, descriptive, and demonstrative oral presentations.

RELATED ACADEMIC TOPICS FOR MATHEMATICS

M1 Relate number relationships, number systems, and number theory.
M2 Explore patterns and functions.
M3 Explore algebraic concepts and processes.
M4 Explore the concepts of measurement.
M5 Explore the geometry of one-, two-, and three-dimensions.
M6 Explore concepts of statistics and probability in real world situations.
M7 Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.

EXPANDED TOPICS FOR MATHEMATICS

TOPIC M1: Relate number relationships, number systems, and number theory.

M1.01 Understand, represent, and use numbers in a variety of equivalent forms (integer, fraction, decimal, percent, exponential, and scientific notation) in real world and mathematical problem situations.
M1.02 Develop number sense for whole numbers, fractions, decimals, integers, and rational numbers.
M1.03 Understand and apply ratios, proportions, and percents in a wide variety of situations.
M1.04 Investigate relationships among fractions, decimals, and percents.
M1.05 Compute with whole numbers, fractions, decimals, integers, and rational numbers.
M1.06 Develop, analyze, and explain procedures for computation and techniques for estimations.
M1.07 Select and use an appropriate method for computing from among mental arithmetic, paper-and-pencil, calculator, and computer methods.
M1.08 Use computation, estimation, and proportions to solve problems.
M1.09 Use estimation to check the reasonableness of results.

TOPIC M2: Explore patterns and functions.

M2.01 Describe, extend, analyze, and create a wide variety of patterns.
M2.02 Describe and represent relationships with tables, graphs, and rules.
M2.03 Analyze functional relationships to explain how a change in one quantity results in a change in another.
M2.04 Use patterns and functions to represent and solve problems.
M2.05 Explore problems and describe results using graphical, numerical, physical, algebraic, and verbal mathematical models or representations.

M2.06 Use a mathematical idea to further their understanding of other mathematical ideas.

M2.07 Apply mathematical thinking and modeling to solve problems that arise in other disciplines, such as art, music, and business.

TOPIC M3: Explore algebraic concepts and processes.

M3.01 Represent situations and explore the interrelationships of number patterns with tables, graphs, verbal rules, and equations.

M3.02 Analyze tables and graphs to identify properties and relationships and to interpret expressions and equations.

M3.03 Apply algebraic methods to solve a variety of real world and mathematical problems.

TOPIC M4: Explore the concepts of measurement.

M4.01 Estimate, make, and use measurements to describe and compare phenomena.

M4.02 Select appropriate units and tools to measure to the degree of accuracy required in a particular situation.

M4.03 Extend understanding of the concepts of perimeter, area, volume, angle measure, capacity, and weight and mass.

M4.04 Understand and apply reasoning processes, with special attention to spatial reasoning and reasoning with proportions and graphs.

TOPIC M5: Explore the geometry of one-, two-, and three-dimensions.

M5.01 Identify, describe, compare, and classify geometric figures.

M5.02 Visualize and represent geometric figures with special attention to developing spatial sense.

M5.03 Explore transformations of geometric figures.

M5.04 Understand and apply geometric properties and relationships.

M5.05 Classify figures in terms of congruence and similarity and apply these relationships.

TOPIC M6: Explore the concepts of statistics and probability in real world situations.

M6.01 Systematically collect, organize, and describe data.

M6.02 Construct, read, and interpret tables, charts, and graphs.

M6.03 Develop an appreciation for statistical methods as powerful means for decision making.

M6.04 Make predictions that are based on exponential or theoretical probabilities.

M6.05 Develop an appreciation for the pervasive use of probability in the real world.

TOPIC M7: Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.

M7.01 Use computers and/or calculators to process information for all mathematical situations.
M7.02 Use problem-solving approaches to investigate and understand mathematical content.
M7.03 Formulate problems from situations within and outside mathematics.
M7.04 Generalize solutions and strategies to new problem situations.

RELATED ACADEMIC TOPICS FOR SCIENCE

S1 Explain the Anatomy and Physiology of the human body.
S2 Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.
S3 Relate the nine major phyla of the kingdom animalia according to morphology, anatomy, and physiology.
S4 Explore the chemical and physical properties of the earth to include Geology, Meteorology, Oceanography, and the Hydrologic Cycle.
S5 Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.
S6 Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.
S7 Explore the principles of genetic and molecular Biology to include the relationship between traits and patterns of inheritance, population genetics, the structure and function of DNA, and current applications of DNA technology.
S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

EXPANDED TOPICS FOR SCIENCE

TOPIC S1: Explain the Anatomy and Physiology of the human body.

S1.01 Recognize common terminology and meanings.
S1.02 Explore the relationship of the cell to more complex systems within the body.

S1.03 Summarize the functional anatomy of all the major body systems.
S1.04 Relate the physiology of the major body systems to its corresponding anatomy.
S1.05 Compare and contrast disease transmission and treatment within each organ system.
S1.06 Explore the usage of medical technology as related to human organs and organ systems.
S1.07 Explain the chemical composition of body tissue.

TOPIC S2: Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.

S2.01 Identify the major types and structures of plants, viruses, monera, algae protista, and fungi.
S2.02 Explain sexual and asexual reproduction.
S2.03 Describe the ecological importance of plants as related to the environment.
S2.04 Analyze the physical chemical and behavioral process of a plant.

TOPIC S3: Relate the nine major phyla of the kingdom animalia according to morphology, anatomy, and physiology.

S3.01 Explain the morphology, anatomy, and physiology of animals.
S3.02 Describe the characteristics, behaviors, and habitats of selected animals.

TOPIC S4: Explore the chemical and physical properties of the earth to include Geology, Meteorology, Oceanography, and the Hydrologic Cycle.

S4.01 Examine minerals and their identification, products of the rock cycle, byproducts of weathering, and the effects of erosion.
S4.02 Relate the Hydrologic Cycle to include groundwater its zones, movement, and composition; surface water systems, deposits, and runoff.
S4.03 Consider the effects of weather and climate on the environment.
S4.04 Examine the composition of seawater; wave, tides, and currents; organisms, environment, and production of food; energy, food and mineral resources of the oceans.

TOPIC S5: Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.

S5.01 Examine the science of chemistry to include the nature of matter, symbols, formulas and nomenclature, and chemical equations.

S5.02 Identify chemical reactions including precipitation, acids-bases, and reduction-oxidation.

S5.03 Explore the fundamentals of chemical bonding and principles of equilibrium.

S5.04 Relate the behavior of gases.

S5.05 Investigate the structure, reactions, and uses of organic compounds; and investigate nuclear chemistry and radiochemistry.

TOPIC S6: Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.

S6.01 Examine fundamentals of motion of physical bodies and physical dynamics.

S6.02 Explore the concepts and relationships among work, power, and energy.

S6.03 Explore principles, characteristics, and properties of electricity, magnetism, light energy, thermal energy, and wave energy.

S6.04 Identify principles of modern physics related to nuclear physics.

TOPIC S7: Explore the principles of genetic and molecular Biology to include the relationship between traits and patterns of inheritance; population genetics, the structure and function of DNA, and current applications of DNA technology.

S7.01 Examine principles, techniques, and patterns of traits and inheritance in organisms.

S7.02 Apply the concept of population genetics to both microbial and multicellular organism.

S7.03 Identify the structure and function of DNA and the uses of DNA technology in science, industry, and society.

TOPIC S8: Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

S8.01 Apply the components of scientific processes and methods in classroom and laboratory investigations.

S8.02 Observe and practice safe procedures in the classroom and laboratory.

S8.03 Demonstrate proper use and care for scientific equipment.

S8.04 Investigate science careers, and advances in technology.

S8.05 Communicate results of scientific investigations in oral, written, and graphic form.

APPENDIX B:

WORKPLACE SKILLS

APPENDIX B
WORKPLACE SKILLS FOR THE 21ST CENTURY

WP1 Allocates resources (time, money, materials and facilities, and human resources).

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.

WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.

WP5 Selects, applies, and maintains/troubleshoots technology.

WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.

APPENDIX C:

STUDENT COMPETENCY PROFILE

STUDENT COMPETENCY PROFILE

Student: _____

This record is intended to serve as a method of noting student achievement of the competencies in each course. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the program.

In the blank before each competency, place the date on which the student mastered the competency.

Fundamentals for Automotive Machinists (AUV 1116)

_____ 1. Explain safety procedures used in automotive machinist industry.
_____ 2. Demonstrate precision measurements using steel rule, machinist rule, calipers, micrometers, and gauges.
_____ 3. Demonstrate safe and proper use and storage of tools and equipment in a machinist shop.
_____ 4. Apply methods of identification and cleaning of engine parts.

Cylinder Head Service (AUV 1216)

_____ 1. Disassemble cylinder head and identify all parts.
_____ 2. Resurface cylinder head to manufacturer's specifications.
_____ 3. Recondition valve seats, valve guides, and valve surfaces to manufacturer's specifications.
_____ 4. Complete assembly of the cylinder head according to manufacturer's specifications.

Cylinder Block Service (AUV 1316)

_____ 1. Bore and hone cylinders.
_____ 2. Set up and grind a crankshaft to manufacturer's specifications.
_____ 3. Resize connecting rods to manufacturer's specifications.
_____ 4. Demonstrate internal or external engine balancing techniques.

Engine Assembly and Testing (AUV 1416)

_____ 1. Assemble all engine components and torque to manufacturer's specifications.

Special Problem in Automotive Machinist (AUV 191(1-3))

_____ 1. Prepare a written agreement.
_____ 2. Prepare a written report of activities.
_____ 3. Follow written guidelines for special problems.

Work-Based Learning in Automotive Machinist (AUV 192(1-6))

_____ 1. Apply technical skills needed to be a viable member of the work force.
_____ 2. Apply skills developed in other program area courses.
_____ 3. Apply human relationship skills.
_____ 4. Apply and practice positive work habits and responsibilities.
_____ 5. Work with instructor and employer to develop written occupational objectives to be accomplished.
_____ 6. Assess accomplishment of objectives.
_____ 7. Utilize a set of written guidelines for the work-based learning program.

Parts and Labor (AUV 1513)

_____ 1. Arrange parts and supplies for inventory and distribution ease.
_____ 2. Organize a core recovery system.

Advanced Crankshaft Balance and Grinding (AUV 1613)

_____ 1. Measure dynamic and couple unbalance.
_____ 2. Measure stroke and index variation of all rod journals.

Brake Rotor and Drum Machining (AUV 1713)

_____ 1. Describe and identify various components of a brake system.
_____ 2. Set up brake drum and disk lathe machine.