

FRAMEWORKS FOR  
VOCATIONAL-TECHNICAL PROGRAMS  
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## Foreword

Secondary vocational-technical education programs in Mississippi are faced with many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing true learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, Mississippi Code of 1972, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, ch. 487, §14; Laws, 1991, ch. 423, §1; Laws, 1992, ch. 519, §4 eff. from and after July 1, 1992; Carl D. Perkins Vocational Education Act III, 1998; and No Child Left Behind Act of 2001).

Each secondary vocational-technical course consists of a series of instructional units which focus on a common theme. All units have been written using a common format which includes the following components:

- Unit Number and Title
- Suggested Time on Task - An estimated number of clock hours of instruction that should be required to teach the competencies and objectives of the unit. A minimum of 140 hours of instruction is required for each Carnegie unit credit. The curriculum framework should account for approximately 75-80 percent of the time in the course.
- Competencies and Suggested Objectives
  - A competency represents a general concept or performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies.
  - The suggested objectives represent the enabling and supporting knowledge and performances that will indicate mastery of the competency at the course level.
- Suggested Teaching Strategies - This section of each unit indicates strategies that can be used to enable students to master each competency. Emphasis has been placed on strategies which reflect active learning methodologies. Teachers should feel free to modify or enhance these suggestions based on needs of their students and resources available in order to provide optimum learning experiences for their students.
- Suggested Assessment Strategies - This section indicates strategies that can be used to measure student mastery. Examples of suggested strategies could include rubrics, class participation, reflection, and journaling. Again, teachers should feel free to modify or enhance these suggested assessment strategies based on local needs and resources.

- Integrated Academic Topics, Workplace Skills, Technology Standards, and Occupational Standards - This section identifies related academic topics as required in the Subject Area Assessment Program (SATP) in Algebra I, Biology I, English II, and U. S. History from 1877, which are integrated into the content of the unit. It also identifies the 21<sup>st</sup> Century Skills, which were developed by the Partnership for 21<sup>st</sup> Century Skills, a group of business and education organizations concerned about the gap between the knowledge and skills learned in school and those needed in communities and the workplace. A portion of the 21<sup>st</sup> Century Skills addresses learning skills needed in the 21<sup>st</sup> century, including information and communication skills, thinking and problem-solving skills, and interpersonal and self-directional skills. The need for these types of skills has been recognized for some time and the 21<sup>st</sup> Century Skills are adapted in part from the 1991 report from the U.S. Secretary of Labor's Commission on Achieving Necessary Skills (SCANS). Another important aspect of learning and working in the 21<sup>st</sup> century involves technology skills, and the International Society for Technology in Education, developers of the National Educational Technology Standards (NETS), were strategic partners in the Partnership for 21<sup>st</sup> Century Skills.
- References - A list of suggested references is provided for each unit. The list includes some of the primary instructional resources that may be used to teach the competencies and suggested objectives. Again, these resources are suggested and the list may be modified or enhanced based on needs and abilities of students and on available resources.

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## AGRICULTURE EDUCATION

### **Program Description Agriculture Power and Machinery**

Agriculture Power and Machinery is an instructional program designed to provide basic skills for students to become employed in the industry of agricultural power mechanics or to continue their education in postsecondary institutions. Skills taught in the program relate to selection, operation, service, maintenance, and repair of a variety of agricultural power units and agricultural machinery and equipment. The program includes instruction in gasoline and diesel engines, welding, hydraulics, and other power systems. This program makes use of the FFA Leadership, Professional Development Activities, and Supervised Agricultural Experience Program as integral learning laboratories.

General equipment maintenance and operation are covered in this course. Specific equipment, such as tillage, turf/lawn care, irrigation, harvesting, and forage equipment, is covered in the postsecondary course.

Industry standards referenced are from the *Career Cluster Resources for Agriculture, Food, and Natural Resources* as published by the National Association. The complete text of this document can be found at <http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf>.

## Course Outline

### Agriculture Power and Equipment I

Course CIP Code: 01.0201

**Course Description:** Agriculture Power and Equipment I is the entry-level course of the secondary Agriculture Power and Machinery program. Students in this course will gain basic skills and knowledge related to safety, measurement, fasteners, welding and cutting, mechanics, equipment maintenance, and agricultural equipment. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Introduction	10
2	Safety	15
3	Measurement	20
4	Fasteners	10
5	Oxyfuel Cutting	15
6	Arc Welding (SMAW)	28
7	Mechanics and Power Transmission	20
8	Compact Engines Service and Repair	45
9	Equipment/Systems Maintenance	22
10	Repairing and Refinishing Agricultural Equipment	25

### Agriculture Power and Equipment II

Course CIP Code: 01.0290

**Course Description:** Agriculture Power and Equipment II is the completion level course of the secondary Agriculture Power and Machinery program. Students in this course will gain additional skills related to safety, advanced welding and cutting, diesel engines, equipment operation and maintenance, and advanced topics in agriculture. (2-2½ Carnegie units, depending upon time spent in this course)

Unit	Title	Hours
1	Orientation and Safety (Review and Reinforcement)	20
2	Advanced Cutting and Welding	40
3	Hydraulic Systems	20
4	Diesel Engines	40
5	Electrical/Electronics Systems	30
6	Agricultural Equipment Operation	20
7	Periodic and Seasonal Maintenance	10
8	Applying Principles of Diagnostics	15
9	Advanced Technology in Agriculture	15

**Course Name:** Agriculture Power and Equipment I  
**Course CIP Code:** 01.0201

1. Explain the requirements and working conditions for employment in the Agriculture Power and Machinery industry.
  - a. Describe employment opportunities in the Agriculture Power and Machinery industry.
  - b. Describe education and experience requirements for employment in the Agriculture Power and Machinery industry.
  - c. Describe earning and working conditions in the Agriculture Power and Machinery industry.
  - d. Describe employability skills necessary for employment in the Agriculture Power and Machinery industry.
  - e. Complete a job application.
  - f. Complete a personal resume.
  - g. Conduct a job interview.
2. Explain the local school rules and regulations.
  - a. Describe local school rules found in the student handbook.
  - b. Describe attendance policies.
  - c. Describe laboratory and facilities associated with the program
  - d. Compare and contrast school and industry expectations.
3. Identify FFA activities pertaining to Agriculture Power and Machinery.
  - a. Describe the purposes of the FFA organization.
  - b. Participate in the leadership and personal development activities and competitive events of FFA.
4. Identify the purposes, requirements, and types of the Supervised Agricultural Experience (SAE) programs.
  - a. Explain the purposes of the SAE program.
  - b. Identify the requirements of the SAE.
  - c. Compare the types of SAE programs.
  - d. Plan SAE activities for the coming year.
5. Maintain agriculture record keeping for the SAE.
  - a. Maintain income and expense records.
  - b. Prepare inventory records.
  - c. Compute a net worth statement.
  - d. Maintain records of supplementary and improvement activities and leadership development activities.
6. Explain the general laboratory safety requirements for Agriculture Power and Machinery.
  - a. Describe personal safety rules for working in the laboratory and/or Agriculture Power and Machinery industry, including the eye safety law.
  - b. Describe general workplace safety rules.
  - c. Describe the proper use of fire extinguishers and classes of fires.
  - d. Identify standard industry Safety Color Code.
  - e. Describe procedures for safely handling heavy objects.
  - f. Identify safety precautions and devices associated with the use of electricity.
  - g. Describe accident reporting procedures.

7. Identify hazardous materials that may be found in the laboratory or on a job site and describe procedures for handling/avoidance or removal of materials.
  - a. Review MSDS sheet to identify hazardous materials.
  - b. Describe the approved storage procedures for flammable materials found in the Agriculture Power and Machinery laboratory.
  - c. Describe approved procedures for disposal of hazardous materials.
  - d. Demonstrate safe procedures for the use of storage batteries.
8. Demonstrate use of hand tools used in Agriculture Power and Machinery.
  - a. Identify basic hand tools used in Agriculture Power and Machinery (wrenches, sockets and accessories, screwdrivers, pliers, hammers, punches and chisels, etc.).
  - b. Demonstrate use of hand tools used in Agriculture Power and Machinery.
9. Demonstrate use of portable power tools found in the Agriculture Power and Machinery laboratory.
  - a. Identify types of portable power tools used in Agriculture Power and Machinery (grinders, drills/drivers, impact wrenches, saws, and presses, etc).
  - b. Demonstrate safety procedures for use of portable power tools used in Agriculture Power and Machinery.
  - c. Demonstrate the use of portable power tools used in the Agriculture Power and Machinery laboratory.
10. Demonstrate the use of stationary tools used in Agriculture Power and Machinery.
  - a. Identify stationary tools used in the Agriculture Power and Machinery laboratory (band saws, drill presses, hydraulic shears, pedestal/bench grinders, abrasive cut-off saws, etc).
  - b. Describe the functions of stationary power tools used in Agriculture Power and Machinery.
  - c. Describe safety rules of stationary power tools used in Agriculture Power and Machinery.
  - d. Demonstrate use of each stationary power tool used in Agriculture Power and Machinery.
  - e. Perform maintenance procedures on each stationary power tool used in Agriculture Power and Machinery.
11. Demonstrate use of lifting, hoisting, and supporting equipment used in Agriculture Power and Machinery.
  - a. Identify lifting, hoisting, and supporting equipment used in Agriculture Power and Machinery (jacks, jack stands, hoists, floor cranes, overhead cranes, chains and slings, etc.).
  - b. Demonstrate safety rules for using lifting, hoisting, and supporting equipment in Agriculture Power and Machinery.
  - c. Demonstrate use of lifting, hoisting, and supporting equipment in Agriculture Power and Machinery.
12. Identify types of measuring devices used in Agriculture Power and Machinery.
  - a. Identify types of measuring devices used in Agriculture Power and Machinery, including tape measure, rules, micrometers, calipers, dial indicators, and thickness gauges.
  - b. Demonstrate ability to use types of measuring devices used in Agriculture Power and Machinery, including tape measures, rules, micrometers, calipers, dial indicators, and thickness gauges.

13. Apply English and metric systems of measurement.
  - a. Describe English and metric units for measuring distance, area, weight, and volume.
  - b. Convert measurements from metric to English units and vice versa.
14. Select typical fasteners used in agriculture power and machinery including bolts, nuts, washers, keys, snap rings, screws, pins, and studs.
  - a. Identify common fasteners used in Agriculture Power and Machinery including screws, bolts, nuts, washers, keys, snap rings, pins, and studs.
  - b. Identify bolt types, grades, and thread measuring terms.
  - c. Measure bolt and nut length, diameter, and thread type.
  - d. Discuss tools and procedures for extracting broken bolts and restoring internal and external threads.
  - e. Identify tools and equipment used to create internal and external threads.
15. Assemble and handle oxyfuel cutting equipment.
  - a. Discuss safety procedures for set up of oxyfuel cutting equipment.
  - b. Identify parts of the oxyfuel cutting equipment including regulators, hoses, fittings, torch body, cutting tips, and accessories.
  - c. Assemble oxyfuel cutting equipment including purging of lines and testing for leaks.
  - d. Demonstrate procedures for handling and storing oxyfuel cylinders and equipment.
16. Operate oxyfuel cutting equipment.
  - a. Demonstrate safety procedures for operating oxyfuel cutting equipment.
  - b. Demonstrate procedures for lighting oxyfuel torch and adjusting an oxyfuel cutting torch.
  - c. Adjust the flame to produce oxidizing, carburizing, and neutral flames.
  - d. Demonstrate procedures to make a cut in mild steel.
17. Set up SMAW welding equipment.
  - a. Identify equipment and tools used in arc welding.
  - b. Describe safety procedures used in arc welding.
  - c. Identify different electrodes and the meanings of the numbers in the electrode classification system.
  - d. Identify the types of weld joints and weld positions.
18. Demonstrate procedures for SMAW arc welding.
  - a. Demonstrate safety procedures for arc welding.
  - b. Demonstrate the process for initiating an arc weld (striking an arc).
  - c. Demonstrate procedures to lay a stringer bead and develop a pad.
  - d. Demonstrate procedures to construct a butt weld in the flat position.
  - e. Demonstrate procedures to construct a fillet weld in the flat position.
19. Explain the concepts of power including work, force, and torque, and the elements of power including PTO (power take off) horsepower, drawbar horsepower, and brake horsepower.
  - a. Explain concepts of Newton's Laws.
  - b. Describe the terms of power including work, force, and torque.
  - c. Explain the differences in PTO, drawbar, and brake horsepower.
20. Explain methods of power transmission and braking.
  - a. Describe the transmission of power through direct drive.

- b. Describe the transmission of power through pulleys and belts.
  - c. Describe the transmission of power through chains and sprockets.
  - d. Describe the transmission of power through gears and shafts.
  - e. Describe the transmission of power through hydraulic and pneumatic applications.
21. Identify the different types and discuss their operation and use of clutches.
- a. Describe types of clutches and their operation (centrifugal, mechanical, and hydraulic).
  - b. Identify uses of the different types of clutches.
22. Describe the operation of the four-stroke cycle engine.
- a. Identify the major components (intake, compression, power, and exhaust) of a four-stroke cycle engine.
  - b. Describe the events occurring in one cycle of a four-stroke engine.
23. Describe the operation of the two-stroke cycle engine.
- a. Identify the components of a two-stroke cycle engine.
  - b. Describe the events occurring in one cycle of a two-stroke engine.
  - c. Calculate ratios of oil and gasoline and mix fuel for a two-stroke cycle engine.
24. Describe the basic operation and service of electrical systems.
- a. Understand the basic concept of Ohm's Law.
  - b. Define common terms used in the electrical system (AC, DC, volts, watts, amps, ohms, etc.).
  - c. Identify the common sources of electricity (battery, magneto, generator, alternator).
  - d. Identify the parts of a basic circuit.
  - e. Identify the instruments used in checking electrical circuits.
  - f. Measure voltage, amperage, and resistance of the electrical circuits.
  - g. Service the ignition circuit on a compact gas engine.
25. Perform compact gasoline engine service.
- a. Demonstrate how to find and use information in operator's manuals and manufacturer's specifications.
  - b. Describe the functions of engine oil.
  - c. Describe the Society of Automotive Engineers (SAE) viscosity rating system.
  - d. Describe the American Petroleum Institute (API) classifications.
  - e. Select compact engine oil viscosity according to seasonal temperature.
  - f. Identify the components of the cooling system of an air cooled engine.
  - g. Identify the components of a gasoline fuel system on a compact engine.
  - h. Identify the types of carburetors and fuel systems on a compact engine.
  - i. Identify the types of air filters on compact engines.
  - j. Identify the types of governor systems used on compact engines.
  - k. Perform preventative maintenance on compact engines.
26. Disassemble, inspect, and reassemble a compact gasoline engine
- a. Disassemble, clean, and inspect the parts of a compact engine for wear or damage.
  - b. Assemble a compact engine to manufacturer's specifications.
  - c. Performance test and adjust a compact engine.
27. Read and interpret operator's manual to determine daily maintenance on equipment.
- a. Select correct manuals to determine daily maintenance required on equipment.
  - b. Obtain manufacturer's specifications for daily maintenance requirements on equipment.

28. Perform daily maintenance on tractors and equipment.
  - a. Check tires for air pressure.
  - b. Check fluid levels (engine oil, coolant, and hydraulic system).
  - c. Lubricate the chassis and steering linkage.
  - d. Inspect brakes for correct adjustment.
  - e. Check safety equipment and gauges.
29. Identify the different types of equipment used in agricultural operations and describe their operation and key maintenance procedures.
  - a. Identify types of planting and tillage equipment and describe their operation and key maintenance procedures.
  - b. Identify types of lawn turf equipment and describe their operation and key maintenance procedures.
  - c. Identify types of harvesting equipment and describe their operation and key maintenance procedures.
  - d. Identify types of forage equipment and describe their operation and key maintenance procedures.
  - e. Identify types of irrigation equipment and describe their operation and key maintenance procedures.
  - f. Identify types of poultry equipment and describe their operation and key maintenance procedures.
  - g. Identify types of forestry equipment and describe their operation and key maintenance procedures.
30. Describe procedures for preparing agricultural equipment for refinishing.
  - a. Perform procedures for cleaning equipment for refinishing.
  - b. Repair and/or replace damaged parts.
  - c. Prepare surface for repainting.
31. Demonstrate procedures for repainting agricultural equipment.
  - a. Demonstrate procedures to mix and prepare paint for spraying.
  - b. Set up and adjust paint gun.
  - c. Apply paint coats according to manufacturer's specifications.
  - d. Clean and prepare paint gun for storage.

**Course Name:** Agriculture Power and Equipment II  
**Course CIP Code:** 01.0290

1. Review the local school rules and regulations.
  - a. Describe local school rules found in the student handbook.
  - b. Describe attendance policies.
  - c. Describe laboratory and facilities associated with the program.
2. Identify FFA activities pertaining to Agriculture Power and Machinery.
  - a. Describe the purposes of the FFA organization.
  - b. Participate in the leadership and personal development activities and competitive events of FFA.
3. Update SAE plan of activities for the coming year.
4. Maintain agriculture recordkeeping for the SAE.
  - a. Maintain income and expense records.
  - b. Prepare inventory records.
  - c. Compute a net worth statement.
  - d. Maintain records of supplementary and improvement activities and leadership development activities.
5. Perform Plasma Arc Cutting (PAC).
  - a. Demonstrate safety procedures for PAC.
  - b. Set up PAC equipment.
  - c. Cut mild steel with PAC equipment.
6. Perform advanced arc welding.
  - a. Perform vertical and horizontal butt welds in mild steel.
  - b. Perform fillet and lap welds in vertical and horizontal positions.
7. Perform Metal Inert Gas (MIG) welding.
  - a. Demonstrate safety procedures for MIG welding.
  - b. Identify and describe the use of different supplies and accessories associated with MIG welding.
  - c. Set up MIG welding equipment.
  - d. Weld mild steel with MIG welding equipment in the flat, vertical, horizontal, and overhead positions.
8. Perform Tungsten Arc (TIG) welding.
  - a. Demonstrate safety procedures for TIG welding.
  - b. Identify accessories and supplies used in TIG welding and describe their use.
  - c. Set up TIG welding equipment.
  - d. Weld aluminum and stainless steel with TIG welding equipment.
9. Explain principles of hydraulics.
  - a. Describe safety precautions related to hydraulics systems.
  - b. Describe the physical laws hydraulics.
  - c. Read and interpret hydraulics schematics.
10. Explain the functions of the basic hydraulic components.
  - a. Identify the basic hydraulic components.
  - b. Describe how basic hydraulics components function.
11. Demonstrate maintenance of hydraulic systems.
  - a. Check fluid levels and condition.
  - b. Service filter system.

- c. Change hydraulic fluids.
  - d. Inspect system for external leaks and correct where necessary.
12. Test a hydraulic system.
  - a. Use the manufacturer's service library to determine specifications.
  - b. Pressure test a hydraulic system.
13. Describe basic operating principals of diesel engines.
  - a. Identify the differences in a diesel engine and a gasoline engine.
  - b. Describe the sequence of events in a four-stroke cycle diesel engine.
14. Identify the components of the diesel engine.
  - a. Identify the components of the basic engine block assembly including the cylinder head, pistons, connecting rods, crankshaft and bearings, camshaft and bearings, cylinder liners, and engine block.
  - b. Describe the functions of the components of the diesel engine including the cylinder head, pistons, connecting rods, crankshaft and bearings, camshaft and bearings, cylinder liners, and engine block.
15. Identify the components of the lubrication system.
  - a. Identify the oil pump, oil cooler, filter, and relief valve.
  - b. Describe the functions of the oil pump, oil cooler, filter, and relief valve.
16. Identify the components of cooling system.
  - a. Identify the components of the cooling system including radiator, thermostat, water pump, radiator cap, radiator hoses, belts and pulleys, coolant and shroud.
  - b. Describe the functions of the components of the cooling system including radiator, thermostat, water pump, radiator cap, radiator hoses, belts and pulleys, coolant and shroud.
17. Identify the components of fuel system.
  - a. Identify the components of the fuel system including reservoir, transfer pump, injector pump, injectors, filter, valves, lines and hoses, and fuel.
  - b. Describe the functions of the components of the fuel system including reservoir, transfer pump, injector pump, injectors, filter, valves, lines and hoses, and fuel.
18. Disassemble and assemble a diesel engine and service the support systems.
  - a. Disassemble a diesel engine.
  - b. Inspect components according to manufacturer's specifications.
  - c. Assemble a diesel engine and service the support system components.
19. Describe the use of electronics systems used in agriculture.
  - a. Describe uses of sensors and monitoring systems.
  - b. Describe uses of controllers.
  - c. Discuss the role of integrated systems.
  - d. Identify the types of electric motors and their application and use.
20. Investigate electronics systems used on tractors, implements, and stationary systems.
  - a. Discuss the use of electronic sensors, processors, and controllers on tractors and implements.
  - b. Identify components of electronic systems and their function or purpose.
  - c. Interpret electronic schematics, and blueprints.
21. Identify parts and functions of charging systems on internal combustion engines.
  - a. Describe safety procedures for the charging system.
  - b. Identify the components of the charging system.
  - c. Test charging circuit operation according to specifications.

- d. Service the charging system.
- 22. Identify components and functions of starting systems on internal combustion engines.
  - a. Describe safety procedures for the storage battery.
  - b. Identify the components of the starting system.
  - c. Test starting system components according to specifications.
  - d. Service components of a starting system according to specifications.
- 23. Describe principles of diagnostics.
  - a. Explain the meaning and importance of diagnostics.
  - b. Describe the processes and tools used in equipment diagnostics.
  - c. Apply diagnostic procedures in solving a problem.
- 24. Review the operator's manuals to determine procedures for safe operation of agricultural equipment.
  - a. Identify equipment controls and describe their function.
  - b. Identify instruments and indicators and describe their function.
- 25. Operate tractor and equipment safely.
  - a. Conduct inspection prior to operation.
  - b. Operate the tractor safely including starting, warm-up, clutch engagement, and brake controls.
  - c. Attach, set up, and adjust an implement on a tractor.
  - d. Demonstrate operation under field conditions.
- 26. Review manufacturer's manuals for periodic maintenance.
  - a. Read and interpret manufacturer's manuals to obtain specifications for periodic maintenance.
  - b. Perform periodic maintenance according to manufacturer's specifications.
- 27. Review manufacturer's manuals for seasonal maintenance.
  - a. Read and interpret manufacturer's manuals to obtain specifications for seasonal maintenance.
  - b. Perform seasonal maintenance according to manufacturer's specifications.
- 28. Research advanced technology being utilized in agriculture.
  - a. Establish areas of new technology applications.
  - b. Determine locations where demonstrations may be observed.
  - c. Conduct investigations to observe and record applications of advanced technology.
- 29. Discuss the concepts and operating principles of precision agriculture technology.
  - a. Identify and describe the components of a precision agriculture technology system.
  - b. Describe the use of global positioning receivers in precision agriculture.
  - c. Describe the use of spatial imagery in precision agriculture.
  - d. Describe the use of geographic information system software in precision agriculture.
  - e. Describe the use of variable rate application in precision agriculture.
  - f. Describe the use of yield monitoring in precision agriculture.

## **Program Description**

### **Agriscience**

Agriscience provides a study of selected areas of agricultural science. Students will investigate agricultural science topics including biotechnology, animal science, mechanical technology, food science, fiber science, plant science, soil science, environmental and natural resources, and entomology. These concepts are taught through classroom and laboratory instruction and applications such as the Supervised Agricultural Experience Program (SAE) and FFA Career Development Activities. This program will utilize the problem solving method of instruction and will rely upon the agricultural information systems, including the Internet. Leadership, citizenship, and cooperation skills are taught through participation in FFA activities. The FFA is an intra-curricular vocational student organization designed to provide a learning laboratory for the implementation of this curriculum. Graduates may be employed at the entry level or pursue careers through agriculture, agribusiness, or natural resources education in postsecondary or higher education.

Agriscience is intended to be a two-year course of study. Students completing the first year of the program will receive one Carnegie unit in science (seniors of school year 2007-2008). Students completing the two-course sequence will receive two Carnegie units in science (seniors of school year 2008-2009 and later). Students completing the Supervised Agricultural Experience (SAE) may receive an additional 0.5 Carnegie units for each year.

Industry standards referenced are from the *Career Cluster Resources for Agriculture, Food, and Natural Resources*, National Association of State Directors of Career and Technical Education.

## Course Outline

### Agriscience I

Course CIP Code: 02.9991

**Course Description:** Students in Agriscience I will gain foundation competencies related to careers and opportunities in agriscience, application of safety and the scientific method in agriscience, human relations/leadership/FFA activities, developing a supervised agricultural experience program in agriscience, biotechnology, animal science, mechanical science, principles of fiber science, plant science, soil science, environmental science and natural resources, and entomology. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Agriscience Introduction, Opportunities, and Careers	20
2	Agriscience Lab Safety and the Scientific Method	10
3	Human Relations/Leadership/FFA Activities	15
4	Developing a Supervised Agricultural Experience (SAE) in Agriscience	15
5	Biotechnology	20
6	Animal Science	20
7	Mechanical Science	15
8	Principles of Fiber Science	10
9	Plant Science	20
10	Soil Science	20
11	Environmental Science and Natural Resources	20
12	Entomology	20

**Agriscience II**  
Course CIP Code: 02.9992

**Course Description:** Agriscience II is the advanced level course of the secondary Agriscience program. Students in Agriscience II will gain foundation competencies related to communication and career skills, developing a supervised agricultural experience program in agriscience, advanced biotechnology, food science, advanced plant science, advanced soil science, advanced environmental science and natural resources, aquaculture, and advanced animal science. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Communication and Career Skills	10
2	Supervised Agricultural Experience (SAE) in Agriscience (Review)	15
3	Advanced Biotechnology	30
4	Food Science	20
5	Advanced Plant Science	25
6	Advanced Soil Science	25
7	Advanced Environmental Science and Natural Resources	30
8	Aquaculture	25
9	Advanced Animal Science	30

**Course Name:** Agriscience I

**Course CIP Code:** 02.9991

### **Competencies and Suggested Objectives**

1. Introduce concepts and terms associated with agriculture, science, and agriscience.
2. Investigate the major areas of agriculture.
  - a. Examine major areas of agriculture: agricultural processing, agricultural production, agricultural mechanics, agribusiness/supplies and services, forestry, natural resources, horticulture, entomology, aquaculture, animal science, and plant science.
  - b. Describe the importance of the areas in society.
  - c. Discuss the economic impact of the areas in local, state, national, and global economies.
3. Connect major sciences supporting agriscience.
  - a. Examine concepts of biology, chemistry, biochemistry, physical sciences, and biotechnology.
  - b. Relate the use of concepts of pure science to the use of concepts of agriscience.
4. Investigate current trends occurring in agriscience.
  - a. Investigate precision agriculture.
  - b. Investigate niche farming, such as organic farming and alternative animal agriculture.
  - c. Investigate animal tracking.
  - d. Investigate country of origin labeling.
5. Examine the opportunities for careers in agriscience.
6. Demonstrate job seeking skills.
  - a. Conduct an Internet search for employment in a selected agricultural occupation.
  - b. Develop a resume.
  - c. Prepare a job application and cover letter.
  - d. Participate in a role-play interview.
7. Analyze the basic rules of safety in the agriscience laboratory.
  - a. Discuss safe and proper use of chemicals, heat and fire, laboratory equipment, specimens and animals, and electrical equipment.
  - b. Utilize procedures for reporting an accident.
  - c. Examine the “Hazardous Communications Acts” and the “Worker Protection Act” as applied to agricultural occupations.
  - d. Illustrate the use of a Materials Safety Data Sheet (MSDS).
8. Demonstrate all safety equipment in the agriscience laboratory.
9. Practice safety concepts in laboratory activities.
  - a. Use appropriate precautions when working with electrical applications, fire, poisons, and gas.
  - b. Protect hands and eyes.
  - c. Wear proper clothing for protection.
  - d. Safely work with animals and plants.
  - e. Take steps to prevent explosion danger.
10. Examine terms and concepts associated with the scientific method.

11. Describe each step of the scientific method.
  - a. Identify the problem.
  - b. Gather data.
  - c. Formulate possible solutions.
  - d. Implement the preferred solutions.
  - e. Evaluate the results.
12. Apply the scientific method.
  - a. Identify the problem or question to be answered.
  - b. Gather data related to the problem or question.
  - c. Formulate possible solutions.
  - d. Implement one or a combination of several solutions.
  - e. Evaluate the results and pursue further research as needed.
13. Discuss concepts related to leadership.
  - a. Describe leadership.
  - b. Describe traits of a good leader such as integrity, knowledge, courage, tactfulness, enthusiasm, unselfishness, and loyalty.
  - c. Practice acceptable manners in appropriate places, including introductions, greetings, table manners, and telephone manners.
14. Investigate the FFA organization.
  - a. Describe the history of FFA.
  - b. Contrast degrees of membership.
  - c. State the creed.
  - d. Demonstrate official dress.
  - e. Investigate the emblem and its symbols.
15. Explain opportunities for leadership development through the FFA.
  - a. Describe contests and awards programs, including proficiency awards and state and American degrees.
  - b. Participate in personal development seminars.
  - c. Participate in leadership activities and/or leadership conferences and conventions.
  - d. Describe national and international exchange programs.
  - e. Plan for education experience with industry.
  - f. Determine opportunities for participation in personal and community development programs.
16. Participate in parliamentary procedure.
  - a. Define parliamentary terms.
  - b. Introduce a motion.
  - c. Debate amendments.
  - d. Utilize different methods of voting.
  - e. Discuss taps of the gavel.
17. Describe the purposes and requirements of the SAE.
  - a. Establish objectives for the SAE.
  - b. Determine the availability of time and money to invest.
  - c. Select a system of record keeping.
  - d. Determine benefits of participation in an SAE.
  - e. Determine types of SAE programs.

18. Develop a long-range personal plan for the SAE.
  - a. Set long-range goals.
19. Develop a short-range personal plan.
  - a. Set short-range goals.
20. Complete a training agreement for an SAE.
  - a. Establish requirements of student, parents, supervisor, and/or employer.
21. Describe agricultural record keeping for an SAE.
  - a. Determine types of records to keep.
  - b. Describe how to maintain various systems of record keeping.
22. Maintain agricultural records for an SAE.
  - a. Prepare income and expense records.
  - b. Prepare inventory records.
  - c. Compute enterprise summaries.
  - d. Maintain placement records.
  - e. Summarize the SAE program.
  - f. Maintain leadership activity records.
  - g. Compute a net worth statement.
23. Explain the basic principles of heredity.
  - a. Describe the role of genes and chromosomes in heredity.
  - b. Explain the functions of DNA and RNA in heredity.
  - c. Describe the process of cell division in reproduction.
  - d. Discuss mutations, genetic disease, and birth defects in the process of inheritance.
  - e. Calculate a simple problem demonstrating inheritance of dominant and recessive traits.
24. Discuss terms and concepts related to biotechnology.
  - a. Define terms related to biotechnology such as DNA, RNA, allele, phenotype, gene, heterozygous, homozygous, chromosome, plasmids, clone, explant, mutation, enzyme, hybridization, embryo transfer, genetic engineering, selective breeding, gene mapping, gene splicing, applied research, pedigrees, BST, APHIS, *Bacillus thuringiensis*, USDA, EPA, and FDA.
  - b. Examine the history of biotechnology.
  - c. Investigate emerging issues associated with biotechnology.
  - d. Describe issues of bio security which producers of plants and animals should be applying to protect their products from contamination or destruction.
25. Examine contributions which biotechnology makes to agriculture.
  - a. Identify improvements of animals and plants made possible through biotechnology.
  - b. Describe frost protection.
  - c. Discuss photosynthesis research.
  - d. Describe disease and insect resistance.
  - e. Discuss the practice of animal and plant integration used in disease and insect control.
26. Investigate methods of transferring genetic information.
  - a. Describe gene splicing.
  - b. Discuss cloning.
  - c. Describe tissue culture.
  - d. Perform tissue culture.

27. Examine the major body systems of various species.
  - a. Distinguish roles and functions of major body systems.
  - b. Contrast differences in body systems among species.
28. Examine nutrients required by animals for normal growth and development, including their sources, functions, and ration.
  - a. Differentiate the purpose of nutrients, including carbohydrates, fats, proteins, vitamins, minerals, and water.
  - b. Describe nutrient sources, including roughages, concentrates, animal byproducts, minerals, and synthetic nutrients.
  - c. Analyze feed samples.
  - d. Develop a ration for a specific species and class of animal, balancing it using the Pearson Square.
29. Examine animal diseases and their control and treatment.
  - a. Classify animal diseases as contagious and non-contagious.
  - b. Analyze fecal and blood samples for parasites and disease.
  - c. Distinguish methods of controlling and treating diseases such as sanitation, isolation, and vaccination.
  - d. Demonstrate vaccination procedures, including proper injection sites and techniques.
  - e. Examine considerations for drug withdrawal in meat and dairy animals.
  - f. Examine the risks to humans from contagious and non-contagious diseases and parasites.
30. Examine food products and processing.
  - a. Explain methods of processing, preserving, and storing foods.
  - b. Identify the wholesale cuts of major agricultural species of animals.
  - c. Investigate factors of profitability in processing of animal carcasses including processing yield, shrinkage, and fat versus lean content.
31. Explain some of the economic and practical considerations of livestock production.
  - a. Identify management systems of animal production used with beef and dairy cattle, sheep, rabbits, goats, swine, poultry, horses, aquatic species, and other livestock.
  - b. Identify shelter and facilities required for production of livestock.
  - c. Describe types and breeds of livestock.
  - d. Describe feeds and feeding practices required for livestock.
  - e. Calculate a feed conversion ratio.
  - f. Describe the environmental impact of animal waste management on the livestock industry.
  - g. Describe the concept of bio security as it applies to animal production.
  - h. Describe the concerns of hormones, antibiotics, and probiotics used in animal health and production.
  - i. Describe the importance of factors contributing to cost of production of livestock.
  - j. Describe the practice of artificial insemination in livestock production.
32. Demonstrate principles and applications of measurement.
  - a. Demonstrate measurement of linear distance, areas, and volumes using the metric and English systems, including the use of a ruler.
  - b. Demonstrate measurement of land in acres.

- c. Demonstrate measurement using a micrometer and graduated caliper in metric and English systems.
  - d. Demonstrate liquid measure using metric and English systems.
  - e. Demonstrate temperature measurement using the Fahrenheit and Celsius scales.
33. Examine principles and applications of fluid power machines.
  - a. Define hydraulics.
  - b. Demonstrate principles of hydraulics.
34. Identify and calculate mechanical advantages of six simple machines including lever, inclined plane, wheel, fulcrum, pulley, and axle.
  - a. Describe six simple machines including lever, inclined plane, wheel, fulcrum, pulley, and axle.
  - b. Calculate mechanical advantages of six simple machines including lever, inclined plane, wheel, fulcrum, pulley, and axle.
  - c. Demonstrate an example of mechanical advantage by using simple machines.
35. Investigate principles and applications of electricity.
  - a. Describe the basic principles of polarity.
  - b. Troubleshoot and repair electrical systems.
  - c. Measure electrical values using a multimeter.
  - d. Calculate watts, amperes, and volts.
  - e. Calculate kilowatt hours.
  - f. Wire simple residential electrical circuits including a light controlled by a switch and a convenience outlet for 110 volt systems.
36. Examine fiber science concepts.
  - a. Define terms related to fiber science such as cellulose, lignin, crimp, staple length, boll, pulp, and kenaf.
37. Investigate the fiber industry and its economic importance in relation to clothing, paper, textiles, and lumber.
  - a. Investigate the local, state, national, and global economic impact of the fiber industry.
  - b. Describe how technology and mechanization has revolutionized the fiber industry.
  - c. Describe the need for plant fibers.
  - d. Describe the need for animal fibers.
  - e. Investigate the lumber industry and methods to calculate board feet and running (linear) feet.
38. Describe the ginning process for cotton.
  - a. Discuss the history of the ginning process.
  - b. Describe the ginning process for cotton including fiber and uses of the byproducts including seed, hulls, and oil.
39. Investigate the paper making process.
  - a. Describe the paper making process including types of paper and the byproducts produced.
40. Examine plant science concepts.
  - a. Define terms associated with plant science such as chlorophyll, allelopathy, herbaceous, and pubescence.
41. Investigate major structural parts of plants including roots, stems, and leaves.
  - a. Describe functions of structural parts of plants.

- b. Explain the food storage processes in roots, stems, and seeds.
- 42. Categorize the classes of agricultural plants.
  - a. Examine differences among and classify annuals, perennials, and biennials.
  - b. Examine differences between and classify monocotyledons and dicotyledons.
  - c. Examine differences between and classify deciduous and evergreen.
- 43. Determine the nutrients needed for proper plant growth.
  - a. Identify secondary and primary plant nutrients.
  - b. Investigate differences between micronutrients and macronutrients.
  - c. Determine fertilizer types and amounts needed by plants for proper growth.
  - d. Analyze the effects of nutrients, water, and pH on plants.
- 44. Investigate irrigation systems for various applications.
  - a. Examine the uses for drip, flood, sprinkler, and hose and bib systems.
- 45. Examine common plant pests and diseases and control methods.
  - a. Identify common plant pests.
  - b. Examine common plant diseases and their causal agents including nutritional causes and bacteria, fungi, and viruses.
  - c. Determine methods of pest control.
  - d. Determine methods of disease control.
- 46. Explain the important plant growth and food production processes.
  - a. Describe photosynthesis.
  - b. Describe transpiration.
  - c. Describe respiration.
  - d. Investigate principles of photosynthesis, transpiration, respiration, and the absence of plant nutrients.
- 47. Examine various methods of plant reproduction.
  - a. Describe the functions of complete and incomplete flowers.
  - b. Label the reproductive parts of a flower.
  - c. Contrast differences in sexual and asexual reproduction.
  - d. Describe principles of plant pollination.
- 48. Determine soil textures from clay, sand, and silt based soils.
- 49. Determine factors affecting soil classification and capability classes including slope and drainage, permeability, texture, and depth of top soil.
- 50. Apply procedures for collecting and utilizing soil samples.
  - a. Collect and process a soil sample.
  - b. Analyze a soil sample for primary nutrients and pH.
  - c. Recommend soil amendments such as macronutrients, micronutrients, fertilizers, and pH adjustments.
- 51. Investigate factors contributing to soil erosion and various methods of control.
  - a. Investigate principles and methods of soil tillage.
  - b. Examine soil conservation methods.
- 52. Explain the importance of natural resources.
  - a. Describe the importance of forestry, soil, plants, water, and wildlife in the local, county, and state economy.
- 53. Explore the basic concepts of natural resource conservation and management.
  - a. Classify renewable and non-renewable natural resources.
  - b. Discuss the concept of sustainability as related to natural resources and the environment.

54. Examine principles of forestry.
  - a. Compare properties of wood (hardness, weight, shrinkage, warping, and wood working qualities).
  - b. Identify species of trees, comparing hardwoods and softwoods.
  - c. Describe management practices of forest management including growing a wood lot, planning of a harvest cutting, wood lot protection, and prescribed burning.
  - d. Examine principles of silviculture.
55. Identify the characteristics of selected species of wildlife.
  - a. Describe vertebrates and invertebrates.
  - b. Describe interdependency occurring within the wildlife community, including parasitism, mutualism, predation, communalism, and competition.
56. Investigate natural resource contamination.
  - a. Discuss the sources of water and potential threats to each source.
  - b. Discuss sources of air pollution and precautions that can be taken to reduce or prevent pollution.
  - c. Explore ways in which agricultural enterprises protect and enhance air and water quality.
  - d. Test water, air, and soil for contaminants.
57. Define terms related to entomology.
  - a. Define terms such as vector, defoliate, weed, pathogen, entomophagous, metamorphosis, instar, pheromone, and eradication.
58. Investigate insect morphology and classification.
  - a. Review insect morphology.
  - b. Arrange insects based on their scientific classification.
59. Investigate the effects of insects on society and agriculture through history.
  - a. Discuss the effects of diseases such as Dutch elm disease, potato blight, chestnut blight,
  - b. Investigate the effects of insects on crop storage in various climates.
60. Investigate methods of insect control.
  - a. Investigate biological, cultural, mechanical, clean culture, trap crop, pest resurgence, and chemical control methods.
  - b. Develop an integrated pest management plan.

**Course Name:** Agriscience II

**Course CIP Code:** 02.9992

### **Competencies and Suggested Objectives**

1. Prepare and deliver an oral presentation.
  - a. Follow the steps to prepare an oral presentation: identify a topic, develop an outline, collect and compile data, and draft a speech.
  - b. Deliver an oral presentation using the basic principles of public speaking: voice utilization, stage presence, expression, response to questions, and general effect.
2. Utilize communication skills in careers.
  - a. Write a cover letter for an agriscience job.
  - b. Update resume to reflect current activities and experiences.
3. Continue SAE activities in agriscience. (Ongoing)
4. Maintain agricultural records for the SAE.
  - a. Prepare income and expense records.
  - b. Prepare inventory records.
  - c. Compute enterprise summaries.
  - d. Maintain placement records.
  - e. Summarize the SAE program.
  - f. Maintain leadership activity records.
  - g. Compute a net worth statement.
  - h. Fill out proficiency award and State FFA degree applications.
5. Examine biotechnology.
  - a. Review terms.
  - b. Describe benefits to plants, animals, and humans.
  - c. Examine concerns and ethical issues.
  - d. Discuss the environmental impact.
  - e. Examine regulatory control of research and industry use.
  - f. Apply biotechnology techniques including tissue culture and electrophoresis.
6. Explain career opportunities in biotechnology.
  - a. Describe sample work areas of biotechnology in agriculture.
  - b. Describe biotechnology related work areas.
  - c. Describe positions, salary ranges, educational requirements, and certifications for careers in biotechnology.
7. Examine the elements, trends, and career opportunities in the food industry.
  - a. Discuss the food industry.
  - b. Determine the importance of the food industry to the consumer.
  - c. Describe the economic scope of the food industry.
  - d. Identify government requirements and other assurances of food quality and sanitation.
  - e. Compare the major crop and animal commodity production areas in the nation and the world.
  - f. Describe the major food commodity groups and their predominant origins.
  - g. Discuss the major operations that occur in the food industry.
  - h. Investigate career opportunities in food science.
  - i. Describe future developments predicted for the food industry.

8. Examine food customs around the world.
  - a. Investigate food customs around the world.
  - b. Discuss the importance of the appearance of food products and packaging.
9. Analyze the effects of helpful and harmful organisms in food science.
  - a. Analyze the benefits of organisms in the process of culturing organisms to make food products such as yogurt, cheese, or bread.
  - b. Analyze the harmful effects of organisms in processes such as food spoilage.
10. Investigate concepts associated with hydroponics.
  - a. Describe media, medium, hydroponics, amendment, pH, acidity, alkalinity, neutral, primary nutrients, complete fertilizer, starter solutions, water culture, and aquaculture.
  - b. Describe the requirements for water, oxygen, mineral nutrients, light, spacing, temperature, and support.
  - c. Examine types of hydroponics systems, including aggregate culture, water culture, aeroponics, and continuous flow.
11. Investigate greenhouse management.
  - a. Develop a pest and disease control plan using integrated pest management concepts.
  - b. Design and utilize watering systems.
  - c. Examine utilization of space.
12. Explain procedures to apply for a restricted pest management permit.
13. Explain the use of competitive exclusion.
  - a. Identify beneficial and harmful bacteria and other organisms.
  - b. Identify beneficial and harmful plants.
14. Review the role of soil nutrients in plant growth.
  - a. Describe functions of macro and micro nutrients in plant growth.
  - b. Determine macro and micro nutrients in soil samples and pH.
  - c. Recommend fertilizers for various soils.
15. Investigate soil characteristics.
  - a. Describe processes of soil formation.
  - b. Identify the microscopic structure of soil.
  - c. Describe chemical reactions and their effects on soil properties.
  - d. Discuss the components of soil.
  - e. Describe how particle size determines soil texture.
  - f. Examine soil ecology including bacteria, fungi, protozoa, nematodes, and plants.
16. Examine soil and water conservation practices.
  - a. Describe soil degradation.
  - b. Describe the different types of soil erosion and preventative action for each type.
  - c. Describe practices of no-till cropping.
  - d. Describe the water cycle.
  - e. Describe the importance of the water table to water resources management and agricultural irrigation.
  - f. Give examples of types of ground water.
  - g. Describe problems created by failure to manage water resources correctly and preventative action to avoid these problems.
17. Explain the relationship between sustainable agriculture and environment.

18. Identify concepts related to environmental quality.
  - a. Define terms related to air, water, and soil quality such as watershed, aquifer, potable, lacustrine, alluvial, conservation tillage, strip cropping, grass waterway, particulates, and percolation.
  - b. Describe sources of point and non-point pollution of air, water, and soil.
  - c. Describe threats to air, water, and soil quality.
  - d. Investigate the greenhouse effect.
19. Cite important relationships between land characteristics and water quality.
  - a. Describe precipitation.
  - b. Discuss the use of land as a reservoir.
  - c. Identify types of ground water and aquifers.
  - d. Describe benefits of living organisms to water quality.
  - e. Investigate wetland ecology including estuary margins, brackish water, marshes, and swamps.
20. Investigate erosion causes and control.
  - a. Demonstrate the effects of the force of raindrops on soils.
  - b. Discuss the effects of the soil aggregation on absorption.
  - c. Demonstrate the effects of slope on erosion.
  - d. Examine methods of erosion control including living grass, hay, fencing, plant residue, and riparian buffer zones.
21. Investigate aquatic natural resource conservation.
  - a. Examine how aquatic macro invertebrates may be used as water quality indicators.
  - b. Examine how macro vertebrates may be used as water quality indicators.
22. Examine concepts associated with aquaculture.
  - a. Define terms related to aquaculture such as spawn, PPM, dissolved oxygen, buffer, turbidity, Secchi disk, and seining.
  - b. Investigate the economic impact of aquaculture at local, state, national, and global levels.
  - c. Compare terrestrial and aquatic food chains.
23. Identify major aquatic plant and animal species grown or managed for commercial use.
24. Examine water requirements for aquaculture.
  - a. Define terms such as ammonia, nitrite, nitrate, salinity, dissolved oxygen, pH, oxygen demand, and specific gravity.
  - b. Investigate the effects of temperature on aquatic organisms.
25. Explain the major aquaculture production systems.
  - a. Describe caged culture, recirculating tanks, pond culture, and raceways.
  - b. Investigate the role of hatcheries.
  - c. Plan and develop a small-scale aquaculture production system.
26. Explain concepts related to advanced animal science.
  - a. Define terms related to advanced animal science such as artificial insemination, desirable characteristics, genetic probability, pedigree, incomplete dominance, ovulation, heritability, hybrid, hybrid vigor, and colostrum.
  - b. List the gestation and incubation periods for livestock and poultry.

27. Explain how animal traits are passed on to offspring and which traits are best transferred.
  - a. Review genetics concepts.
  - b. Describe desirable characteristics.
  - c. Describe heredity.
  - d. Describe breed selection and improvement.
28. Investigate how products are used to improve animal growth and performance.
  - a. Examine supplemental hormones.
  - b. Investigate feed additives.
  - c. Examine antibiotics.
29. Explain the need and methods for checking the vital signs.
  - a. Describe heart rate and body temperature of different species of animals.
  - b. Demonstrate procedures for checking vital signs.
30. Investigate artificial insemination and embryo transfer.
  - a. Describe the need for artificial insemination in animal science.
  - b. Observe the processes used in artificial insemination of livestock.
  - c. Describe the need for embryo transfer in animal science.
  - d. Observe procedures for embryo transfer.
31. Examine the poultry industry.
  - a. Describe poultry reproduction.
  - b. Investigate steps in egg formation.
  - c. Hatch and care for poultry.
  - d. Discuss areas of poultry production including broilers, layers, and pullets.

## **Program Description Custodian/Caretaker Services**

The secondary program in Custodian/Caretaker Services prepares individuals enrolled at the Mississippi School for the Deaf for entry-level employment or continuing education in a variety of fields in the horticulture and business maintenance industry. Students enrolled in the program participate in a variety of instructional activities including lectures, discussions, laboratory experiences at the school, and work-based learning activities in the field such as field trips and shadowing experiences according to his/her Individualized Education Program (IEP). Students also receive supplementary instruction and reinforcement of learning through activities in the Junior National Association of the Deaf (Jr. NAD). Content areas covered in the two-year program may require three years due to the nature of the IEP. Custodian/Caretaker Services I (Horticulture) topics include: plant structure and growth, plant propagation, pest management, residential/commercial care, floristry, greenhouse crops and management, vegetable production, and landscaping. Custodian/Caretaker Services II (Landscape and Building Maintenance) topics include: nursery/landscape plants, landscape maintenance, plant identification, turfgrass installation and maintenance, building maintenance safety, floor and upholstery care, and bathroom care.

Industry standards referenced are adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*.

**Course Outline**  
**Custodian/Caretaker Services I**  
 Course CIP Code: 20.0604

**Course Description:** Custodian/Caretaker Services I is the introductory course in the secondary Custodian/Caretaker Services program. Students in this course gain a foundation of competencies related to careers and leadership development; plant structure, growth, and classification; general residential/commercial care; growing media; propagation; chemical and pest management; and floristry and greenhouse operations. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Custodian/Caretaker Services Orientation, Safety and Leadership Development	10.5
2	Plant Structure and Growth	25.5
3	General Residential/Commercial Care	30.0
4	Plant Growth Media and Nutrition	25.5
5	Horticulture Structures	10.5
6	Basic Plant Propagation	30.0
7	Principles of Pest Management	22.5
8	Basic Principles of Floristry and Interior Landscaping	22.5
9	Greenhouse Crops	22.5
10	Olericulture (Vegetable) Production	18.0
11	Special Topics in Custodian/Caretaker Services I	22.5

**Custodian/Caretaker Services II**  
 Course CIP Code: 20.0694

**Course Description:** Custodian/Caretaker Services II is a continuation of the secondary Custodian/Caretaker Services program. Students enrolled in this course gain competencies related to landscape and building maintenance which include plant classification, nursery/landscape plants, landscape maintenance, turfgrass installation and maintenance, building maintenance safety, residential/commercial care, floor and upholstery care, and bathroom care. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Leadership, Careers, and Safety	18.0
2	Plant Classification, Nursery and Landscape Plant Identification	25.5
3	Landscape Maintenance	15.0
4	Turfgrass Installation and Maintenance	15.0
5	Building Maintenance Safety	15.0
6	Hard Surface Floor Care	37.5
7	Carpet and Upholstery Care	30.0
8	Residential/Commercial Bathroom Care	37.5
9	Special Topics in Custodian/Caretaker Services II	22.5

**Course Name:** Custodian/Caretaker Services I

**Course CIP Code:** 20.0604

### **Competencies and Suggested Objectives**

1. Identify school and program policies and procedures related to the Custodian/Caretaker Services (CCS) program.
  - a. Describe school policies related to the CCS program.
  - b. Identify and describe policies specific to the CCS program, including policies and procedures associated with supervised experience.
2. Demonstrate basic and fundamental safety practices related to CCS enterprises.
  - a. Identify hazards that may be found in CCS operations and activities such as poisons and other chemicals, sunburn, ladders and scaffolds, electrical shock, fire, poisonous insects and snakes, equipment and tool hazards, spills and slipping, etc.
  - b. Identify and demonstrate the use of personal protection devices including eye protection, hearing protection, foot protection, respiratory protection, clothing, body protection, etc.
  - c. Identify and describe the use of general safety equipment in CCS operations including fire extinguishers, eyewash and shower stations, first-aid kits, etc.
  - d. Identify and apply general safety rules that apply to the CCS classroom and laboratory.
3. Identify and describe the role of organizations that encourage leadership development.
  - a. Identify and describe the role of student youth organizations that encourage leadership development.
  - b. Identify and describe the role of trade organizations in CCS that encourage leadership development.
4. Participate in leadership development activities.
  - a. Identify and describe basic terms and principles associated with leadership.
  - b. Identify and describe basic principles of teamwork and cooperation in small groups.
  - c. Lead a small group in accomplishing a given task. (Ongoing throughout the year)
5. Identify parts of a plant and their functions.
  - a. Identify the primary parts of a plant and describe the function of each part including roots, stems, leaves, and flowers.
  - b. Identify the various types of each primary part, and discuss the differences in each type.
6. Describe the growth process in plants.
  - a. Describe processes by which plants grow including photosynthesis, respiration, transpiration, and translocation.
  - b. Describe the relationship of environmental and cultural factors to plant growth (water, light, temperature, soil, climatic zones, etc.).
7. Demonstrate general residential/commercial cleaning including use of tools/equipment and supplies.
  - a. Identify tools and equipment needed for cleaning a selected area.
  - b. Demonstrate the proper use of tools and equipment needed to clean a selected area.
  - c. Identify supplies needed to clean a selected area.

- d. Demonstrate the use of supplies in cleaning a selected area.
8. Demonstrate proper procedures for cleaning furniture and upholstery.
  - a. Demonstrate the process to dust and polish wood and non-wood furniture.
  - b. Demonstrate the process to clean upholstered furniture.
9. Demonstrate proper procedures for cleaning windows, walls, woodwork, and ceilings/lights, etc.
  - a. Demonstrate the procedure for cleaning windows.
  - b. Demonstrate the procedure for washing walls and woodwork.
  - c. Demonstrate the procedures for cleaning ceilings, lights, etc.
10. Describe and apply principles of plant growth media.
  - a. Identify and compare the components of natural soil, and describe the characteristics each one imparts to the root medium.
  - b. Describe the characteristics of an ideal growing medium.
  - c. Differentiate between a soil and a soilless root medium, and list the common components of a soilless root medium and the characteristics they contribute to the medium.
  - d. Prepare a growing media to specifications, or identify the components and proportions in a commercially prepared root medium and discuss/explain the advantages of a commercial root medium over media containing natural soil.
11. Describe and apply basic principles of plant nutrition.
  - a. Identify the major nutrients needed for plant growth and describe their effects on plant growth.
  - b. Identify the minor nutrients needed for plant growth and describe their effects on plant growth.
  - c. Describe the effect of soil pH on nutrient availability and plant growth.
  - d. Demonstrate the procedure for obtaining a soil sample, from a container and a land-based environment, for a soil test.
  - e. Perform a test to determine plant or soil nutrition and interpret the results to determine the amendments to be made to a given area of root medium to facilitate/produce optimum plant response.
  - f. Interpret fertilizer analysis in terms of major nutrient content.
  - g. Investigate new and emerging technologies, practices, trends, and issues associated with fertilizers and plant nutrition.
12. Describe the characteristics and features of different types of greenhouses.
  - a. Identify and compare the different styles of greenhouses (Quonset, Gothic, lean-to, A-frame, etc.).
  - b. Identify and compare the different types of greenhouse frames (metal, wood, plastic/PVC, etc.) and coverings (fiberglass, glass, polyethylene, lexon, etc.).
  - c. Identify and compare the different types of heating, cooling, and ventilation systems used in greenhouses.
  - d. Identify and compare the types of irrigation and chemigation systems used in greenhouses.
  - e. Identify and describe factors to consider in establishing a floor plan for a greenhouse including benching, flooring, and traffic patterns.
  - f. Describe sanitation practices employed in greenhouse production.

13. Describe auxiliary structures associated with horticulture.
  - a. Describe the functions of auxiliary structures associated with horticultural operations including lathe houses, cold frames, shade houses, hot beds, potting facilities, chemical and dry storage facilities, etc.
14. Investigate and explore new and emerging technologies associated with greenhouse and other horticultural systems and structures.
15. Distinguish between sexual and asexual propagation.
  - a. Describe the distinguishing characteristics of sexual and asexual propagation.
  - b. Explain the advantages and disadvantages of each.
16. Apply principles of sexual reproduction.
  - a. Describe the sexual reproductive process in plants.
  - b. Identify the parts of a seed and describe their functions.
  - c. Identify requirements for optimum seed germination of most seeds.
  - d. Propagate plants from seed.
  - e. Interpret information found on a seed tag.
17. Describe and apply principles of asexual reproduction.
  - a. Identify the common types of asexual reproduction and discuss their applications in horticulture.
  - b. Identify common tools and chemicals used in asexual reproduction and demonstrate their safe use and care.
  - c. Propagate plants from root, stem, and leaf cuttings.
  - d. Propagate plants by division/ separation.
  - e. Propagate plants by layering.
18. Identify and describe factors common to pest management and control.
  - a. Identify and describe the different types of plant pests.
  - b. Identify and describe the different types of control and management practices for plant pests.
  - c. Describe and discuss principles of integrated pest management.
  - d. Describe requirements for pesticide applicator's certification/licensure.
19. Identify, describe, and apply pesticide safety procedures.
  - a. Identify and describe the use of different types of pesticides.
  - b. Interpret pesticide label information.
  - c. Discuss and apply general precautions for working with pesticides.
  - d. Describe first-aid procedures for exposure to pesticides.
20. Identify common plant pests, and describe the ways in which they cause damage to horticultural crops.
  - a. Identify common insect pests of horticultural crops and describe how each causes damage to the crop.
  - b. Identify common diseases of horticultural crops and describe how each causes damage to the crop.
  - c. Identify common weeds found in horticultural crops and describe how weeds cause damage to crops.
  - d. Monitor greenhouse and nursery product for pest management and control. (On-going throughout the year)
21. Describe and apply basic principles of floristry.
  - a. Identify tools and supplies used in floristry including shears, tape, foam, floral wire, etc.

- b. Demonstrate the safe and proper use of tools and supplies used in floristry including shears, tape, foam, floral wire, etc.
  - c. Identify plant materials used in floristry including potted, flower, and foliage materials.
  - d. Describe basic design principles including balance, transition, rhythm, focal point, proportion, scale, etc.
  - e. Create basic floral design products such as a packaged single corsage, wreath, bud vase, round centerpiece, or a dressed (wrapped) potted plant.
22. Describe and apply principles of interior plantscaping.
- a. Describe factors to consider in growing and maintaining plants for interior plantscaping including plant environment, light sources, growing media, fertilization, etc.
  - b. Identify foliage and potted plants used in interior plantscape.
  - c. Describe and discuss procedures for planning, constructing, and maintaining an interior plantscape.
  - d. Describe careers in interior plantscaping.
  - e. Identify plants for specific locations in plantscaping.
  - f. Describe cultural procedures for interior plantscapes including fertilization, watering, sanitation, and pest control.
  - g. Maintain an interior plantscape.
23. Describe and apply principles of greenhouse crop production.
- a. Identify different types of greenhouse crops (bedding plants, vegetables, flowering plants, foliage plants, etc.) and common species of each type.
  - b. Describe cultural considerations for greenhouse crops including fertilizer, water, growing medium, pest control, temperature, natural and chemical growth control and stimulation, and light control for common crops.
  - c. Produce a greenhouse crop following accepted commercial practices. (ongoing throughout the year)
24. Describe and apply principles of olericulture production.
- a. Describe characteristics of common vegetables grown for commercial production including cultural requirements, direct seeding versus transplanting, plant growth style, and growing season; and distinguish between warm season and cool season crops.
  - b. Identify and demonstrate the use of common tools and equipment used in gardening including tillers, spreaders, sprayers, watering devices, rakes, hoes, shovels, etc.
  - c. Identify and describe factors to consider in preparing a seedbed including soil class and texture, use of soil amendments, and characteristics of a properly prepared seedbed.
  - d. Develop a plan for an intensive culture garden including crop and variety selection, location and spacing of different crops, scheduling of crops, crop rotation, and harvesting and marketing of crops.
  - e. Identify common garden pests including insects, diseases, and weeds, and methods of control.
  - f. Discuss new and emerging technologies, trends, and issues concerning the production and marketing of vegetables in Mississippi. Identify and discuss the

- roles of agencies and organizations that regulate the production and marketing of vegetables.
25. Investigate new and emerging technologies, practices, trends, and issues associated with Custodian/Caretaker Services (CCS).
    - a. Prepare a report on a new and emerging technology associated with CCS.
    - b. Prepare a report on a current trend or issue associated with CCS.
  26. Complete school-to-careers activities related to CCS.
    - a. Participate in a school-to-careers activity (shadowing, mentoring, career fair, etc.) related to CCS.
    - b. Investigate educational opportunities related to CCS at the postsecondary level.
    - c. Describe national standards and certification/licensing procedures related to CCS.
    - d. Describe the role of trade organizations, associations, and unions as related to CCS.
  27. Demonstrate related academic skills and workplace skills associated with CCS.
    - a. Complete a cooperative project (paper, presentation, or demonstration) associated with an academic subject and CCS.
    - b. Practice human relations skills (team participation, client/customer service, leadership, negotiation, working with culturally diverse groups, etc.) related to CCS.
    - c. Research work ethics and employer expectations of employees in CCS.
  28. Investigate the concepts of quality assurance as related to CCS.
    - a. Describe quality concepts and methods for measuring quality related to CCS.
    - b. Apply quality concepts in the CCS laboratory.

**Course Name:** Custodian/Caretaker Services II

**Course CIP Code:** 20.0694

### **Competencies and Suggested Objectives**

1. Review program policies and procedures.
  - a. Review program operation policies and procedures, including general safety procedures.
2. Practice leadership skills.
  - a. Identify and discuss fundamental parliamentary procedures for participating in a public meeting.
  - b. Identify and discuss basic principles of public speaking.
3. Complete school-to-careers activities related to CCS.
  - a. Identify employment and career opportunities in the CCS industry.
  - b. Investigate educational opportunities related to CCS at the postsecondary level.
  - c. Describe national standards and certification/licensing procedures related to CCS.
  - d. Describe the role of trade organizations, associations, and unions as related to CCS.
4. Review safety rules and procedures for CCS.
5. Apply systems of plant classification.
  - a. Compare the different systems of plant classification according to life cycle (annual, biennial, and perennial); leaf cycle (evergreen and deciduous); and seed leaf number (monocot and dicot).
  - b. Describe the use of the binomial system in classifying plants including common and scientific names.
  - c. Demonstrate the use of the binomial system.
6. Identify and describe the use of major plants associated with nursery and landscape operations.
  - a. Identify and describe the use of major nursery plants including trees, shrubs, ground covers, vines, and ornamental grasses.
  - b. Identify and describe the use of major flowering plants including annuals, biennials, and perennials.
  - c. Identify and describe the use of major foliage plants used in nursery and landscape operations.
7. Describe and apply principles of landscape maintenance.
  - a. Discuss skills required for year-round landscape maintenance.
  - b. Identify and demonstrate the safe use of equipment and hand tools for landscape maintenance.
  - c. Identify and discuss the proper procedures for pruning trees and shrubs.
  - d. Determine and discuss fertilizer and pest control needs of trees, shrubs, and beds.
  - e. Develop cost estimate for maintenance of trees, shrubs, and beds.
  - f. Discuss maintenance of a landscape irrigation system.
  - g. Describe elements of a contract and warranty agreement for landscape maintenance.
8. Describe and apply principles of turfgrass installation.
  - a. Describe factors to consider in selecting a turfgrass for a specific area.
  - b. Identify varieties of turfgrass and describe their characteristics.

- c. Describe installation practices for different turfgrasses including site preparation and initial care.
  - d. Develop a plan and cost estimate for establishing turf.
9. Describe and apply principles of turfgrass maintenance.
  - a. Identify and demonstrate the safe use of equipment and tools used for turfgrass maintenance including mowers, dethatchers, aerators, etc.
  - b. Mow turf to correct height for a specific grass.
  - c. Identify common pests of turfgrass including insects, diseases, and weeds.
  - d. Calibrate equipment and apply fertilizer to turf in correct proportions.
  - e. Calibrate equipment and apply herbicides, pesticides, and other pest control chemicals in correct proportions.
  - f. Describe common irrigation methods for turfgrass.
  - g. Perform repair/renovation practices including aeration and dethatching.
  - h. Develop a plan/cost estimate for a turfgrass management program.
10. Demonstrate safe and proper maintenance of turf equipment.
11. Describe job-site safety practices including the hazards, carelessness, safety equipment, safety regulations, and accident prevention.
  - a. Recognize key words on product labels.
  - b. Demonstrate how to use cleaning materials safely.
  - c. Identify and demonstrate the ability to use tools and equipment safely.
  - d. Identify and demonstrate the ability to use safety equipment properly.
12. Demonstrate hard surface floor care in commercial or residential areas including sweeping, stain removal, scrubbing, mopping vinyl, brick, wood, stone, and tile.
  - a. Identify proper tools and equipment needed for hard surface floor care.
  - b. Demonstrate the proper use of tools and equipment used in caring for a hard surface floor.
  - c. Identify supplies needed for hard surface floor care.
  - d. Demonstrate the proper use of supplies needed for hard surface floor care.
13. Demonstrate procedures for stripping, sealing, waxing, and buffing hard surface floors including wood, vinyl, brick, stone, and tile.
  - a. Demonstrate the procedure for stripping floors.
  - b. Demonstrate the procedure for sealing floors.
  - c. Demonstrate the procedure for waxing and buffing floors.
14. Demonstrate carpet and upholstery care in commercial and residential areas.
  - a. Identify proper tools and equipment needed for carpet and upholstery care.
  - b. Demonstrate the proper use of tools and equipment used in caring for a carpeted or upholstered area.
  - c. Identify supplies needed for carpet and upholstery care.
  - d. Demonstrate the proper use of supplies needed for carpet or upholstery care.
15. Demonstrate procedures for removing stains, vacuuming, dry cleaning, and steam cleaning of carpet and upholstery including oriental rugs, wool carpets, natural fibers, and synthetic fiber carpets.
  - a. Identify care of various types of carpet and upholstery fabrics.
  - b. Demonstrate the ability to remove stains from carpet and upholstery.
  - c. Demonstrate how to vacuum carpet and upholstery.
  - d. Demonstrate the ability to clean carpet and upholstery using dry foam shampoo.

- e. Demonstrate the ability to clean carpet and upholstery using a steam cleaning process.
16. Demonstrate residential/commercial bathroom cleaning procedures.
    - a. Identify tools and equipment needed for cleaning residential or commercial bathrooms.
    - b. Demonstrate how to use proper tools and equipment for cleaning residential or commercial bathrooms.
    - c. Identify supplies needed to clean a residential/commercial bathroom.
    - d. Demonstrate how to properly use supplies to clean a residential/commercial bathroom.
    - e. Demonstrate the proper procedure(s) for sanitizing all surfaces in a residential/commercial bathroom.
  17. Investigate new and emerging technologies, practices, trends, and issues associated with CCS.
    - a. Prepare a report on a new and emerging technology associated with CCS.
    - b. Prepare a report on a current trend or issue associated with CCS.
  18. Complete school-to-careers activities related to CCS.
    - a. Participate in a school-to-careers activity (shadowing, mentoring, career fair, etc.) related to CCS.
    - b. Investigate educational opportunities related to CCS at the postsecondary level.
    - c. Describe national standards and certification/licensing procedures related to CCS.
    - d. Describe the role of trade organizations, associations, and unions as related to CCS.
  19. Demonstrate related academic skills and workplace skills associated with CCS.
    - a. Complete a cooperative project (paper, presentation, or demonstration) associated with an academic subject and CCS.
    - b. Practice human relations skills (team participation, client/customer service, leadership, negotiation, working with culturally diverse groups, etc.) related to CCS.
    - c. Research work ethics and employer expectations of employees in CCS.
  20. Investigate the concepts of quality assurance as related to CCS.
    - a. Describe quality concepts and methods for measuring quality related to CCS.
    - b. Apply quality concepts in the CCS laboratory.

## **Program Description Food Products (Meats)**

The Food Products (Meats) program is designed to prepare the student for entry level employment in the various related phases of processing, marketing, and merchandising of meats. Students are exposed to career and leadership opportunities within their field of study. Students are given an opportunity to master the skills necessary for success in meat processing which may include slaughtering, chilling, aging, quartering, cutting, and inspecting pork, beef, lamb, poultry, goat, wild game, and fish.

Industry standards referenced are from the *Agriculture, Food, and Natural Resources Standards*.

## Course Outline

### Food Products (Meats) I

Course CIP Code: 01.0401

**Course Description:** Food Products (Meats) I is an instructional program that orients an individual to the field of meat processing, marketing, and merchandising. This course allows an individual to prepare for employment or continued education in the meat cutting, packing, and processing professions. Topics include careers, leadership, and orientation; safety, sanitation, equipment, and facility maintenance; livestock slaughter procedures; and pricing, wrapping, and marketing meats. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Careers and Leadership	15.0
2	Orientation to Meat Processing	15.0
3	Safety, Sanitation, Equipment, and Facility Maintenance	75.0
4	Custom Livestock Slaughter	40.0
5	Pricing, Wrapping, and Marketing	22.5
6	Special Topics in Food Products (Meats) I	32.5

### Food Products (Meats) II

Course CIP Code: 01.0490

**Course Description:** Food Products (Meats) II is a continuation of Food Products (Meats) I. This course allows an individual to prepare for employment or continued education in the meat cutting, packing, and processing professions. Topics include meat cutting; automated processing; quality and yield grading; and curing, smoking, and sausage making. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Identification and Fabrication of Carcass and Box Beef	60.0
2	Identification and Fabrication of Carcass and Box Pork	37.5
3	Identification and Fabrication of Carcass Lamb and Goat	15.0
4	Identification and Fabrication of Poultry and Fish	7.5
5	Identification and Fabrication of Wild Game	20.0
6	Automated Processing of Meats	7.5
7	Quality and Yield Grading	18.0
8	Curing, Smoking, and Sausage Making	18.0
9	Special Topics in Food Products (Meats) II	18.0

**Course Name:** Food Products (Meats) I

**Course CIP Code:** 01.0401

### **Competencies and Suggested Objectives**

1. Explain career opportunities in meat cutting, packing, and processing professions.
  - a. Define meat cutter.
  - b. Research the major categories of job classifications in the meat cutting, packing, and processing profession.
2. Explain the leadership opportunities and activities which are beneficial to students in meat cutting, packing, and processing.
  - a. Identify and describe leadership opportunities available from student youth organizations in the school and community, including FFA and 4-H.
  - b. Describe activities available to students in meat cutting, packing, and processing programs including leadership development, competitions, club meetings, fund raisers, field trips, elected office leadership positions, and service projects.
3. Explain trends in slaughtering and processing in the past and in the future.
  - a. Compare trends in slaughtering and processing in the past 20 years and in the future.
  - b. Discuss emerging technologies related to slaughtering and meat processing.
4. Describe factors affecting consumer food spending.
  - a. Describe factors affecting consumer food spending to include income, geographic area, ethnic group, and religious group.
  - b. Discuss biological health hazards affecting consumer spending.
5. Explain general meat laboratory safety requirements.
  - a. List and practice safety rules and procedures.
  - b. Use meat processing equipment safely.
6. Discuss sanitation as it applies to a meat cutting facility.
  - a. Describe sanitary operations of a meat cutting facility.
  - b. Describe state and federal inspection guidelines as they apply to meat processing facilities, including ways to avoid fecal contamination.
  - c. Identify correct temperatures for meat processing and storage and explain the importance of each.
  - d. Describe the benefits of a rail system.
  - e. Select and use proper aprons, disposable gloves, hard hats, eye protection, hair nets, rubber boots, etc.
  - f. Disinfect aprons and rubber boots after each use.
7. Discuss federal regulations relating to meat processing.
  - a. Discuss HACCP (Hazards Analysis Critical Control Point) as a method to prevent foodborne illness.
  - b. Discuss the role of the USDA Food Safety and Inspection Service relating to quality assurance.
8. Identify and use equipment for meat cutting, packing, and processing.
  - a. Identify equipment used in a meat laboratory including a band saw, grinder, mixer, tenderizer, slicing machine, stuffer, and pickle pump.
  - b. Assemble and disassemble equipment including band saw, grinder, mixer, tenderizer, slicing machine, stuffer, and pickle pump.

- c. Identify, use, and sanitize other meat cutting equipment including knives, knife sharpener, steel and hone, stockinette, dead lock and tag, scales and weighing items, vacuum packer, salinometer, squeegee equipment, patty machine, heat seal, cooler, freezer, rail system, tables, immobilizer, hoist, dehairing machine, skinning knife, and carcass split saw.
  - d. Use sterilizer for knives and steel.
9. Demonstrate equipment maintenance used in a meat cutting facility.
  - a. Maintain a sharp knife including boning and butcher knives.
  - b. Perform equipment and maintenance procedures for grinder, slicer, and band saw.
  - c. Use proper disinfection procedures for cleaning tables after use.
  - d. Demonstrate proper hand washing procedure before and after working in the meat cutting laboratory.
10. Maintain a safe and sanitary facility.
  - a. Wash and disinfect walls and floors.
  - b. Maintain a safe environment by wiping up spills, keeping aisles clear, and performing other tasks.
11. Explain terms and procedures associated with livestock slaughter.
  - a. Define terms and procedures associated with the slaughter of beef.
  - b. Define terms and procedures associated with the slaughter of swine.
  - c. Define terms and procedures associated with the slaughter of lamb and goat.
  - d. Define terms and procedures associated with the slaughter of poultry.
  - e. Define terms and procedures associated with the slaughter of fish.
  - f. Define terms and procedures associated with dressing of wild game.
  - g. Discuss the difference between antemortem and postmortem inspection.
12. Discuss types, cleaning, use, and maintenance of slaughter facility and equipment.
  - a. Identify equipment including immobilizer, skinning knives, rails and rail hooks, scales, dehairing machine, hoist, and carcass split saw.
  - b. Discuss maintenance of a safe and sanitary facility.
  - c. Identify what constitutes contamination from biologic and toxic sources
13. Discuss procedures for slaughtering livestock and dressing wild game.
  - a. Discuss procedures for slaughtering a beef.
  - b. Discuss procedures for slaughtering a swine.
  - c. Discuss procedures for slaughtering a lamb and goat.
  - d. Discuss procedures for dressing wild game.
  - e. Discuss procedures for slaughtering livestock and recognize when to condemn part of a carcass.
  - f. Describe methods of disposing of offal.
14. Compare and contrast consumer trends, supply and demand, and the effects on meat prices.
  - a. Discuss supply and demand and its effects on meat prices.
  - b. Identify current consumer trends.
15. List the steps and perform a cutting test.
  - a. List the steps in a cutting test.
  - b. Perform a cutting test.
16. Discuss techniques and wrap retail meat.
  - a. Discuss techniques of wrapping retail meats.
  - b. Wrap and label meat for home freezing.

- c. Wrap, weigh, label, and price meat for retail sale.
  - d. Describe the proper temperatures for maximum storage life of retail meats using a cooler, display case, or freezer.
  - e. Vacuum seal various cuts of meat.
17. Describe marketing principles related to the display of meat.
  - a. Describe marketing principles related to the display of meat.
  - b. Describe the effects vacuum sealing has on shelf life of meat.
18. Investigate new and emerging technologies, practices, trends, and issues associated with Food Products (Meats).
  - a. Prepare a report on a new and emerging technology associated with Food Products (Meats).
  - b. Prepare a report on a current trend or issue associated with Food Products (Meats).
19. Complete school-to-careers activities related to Food Products (Meats).
  - a. Participate in a school-to-careers activity (shadowing, mentoring, career fair, etc.) related to Food Products (Meats).
  - b. Investigate educational opportunities related to Food Products (Meats) at the postsecondary level.
  - c. Describe national standards and certification/licensing procedures related to Food Products (Meats).
  - d. Describe the role of trade organizations, associations, and unions as related to Food Products (Meats)
20. Demonstrate related academic skills and workplace skills associated with Food Products (Meats).
  - a. Complete a cooperative project (paper, presentation, or demonstration) associated with an academic subject and Food Products (Meats).
  - b. Practice human relations skills (team participation, client/customer service, leadership, negotiation, working with culturally diverse groups, etc.) related to Food Products (Meats).
  - c. Research work ethics and employer expectations of employees in Food Products (Meats).
21. Investigate the concepts of quality assurance as related to Food Products (Meats).
  - a. Describe quality concepts and methods for measuring quality related to Food Products (Meats).
  - b. Apply quality concepts in the Food Products (Meats) laboratory.
22. Examine trends and changes related to Food Products (Meats) and global economic factors.
  - a. Define and discuss the concept of global economics and competition.
  - b. Describe global economic factors and competition as related to Food Products (Meats).
  - c. Identify regions and other countries which compete in Food Products (Meats).

**Course Name:** Food Products (Meats) II  
**Course CIP Code:** 01.0490

### **Competencies and Suggested Objectives**

1. Identify and fabricate cuts of beef.
  - a. Identify carcass break cuts of beef.
  - b. Make retail cuts of round.
  - c. Make retail cuts of loin.
  - d. Make retail cuts of rib.
  - e. Make retail cuts of chuck.
  - f. Make retail cuts of foreshank.
  - g. Make retail cuts of brisket.
  - h. Make retail cuts of plate.
  - i. Make retail cuts of flank.
2. Identify and fabricate variety cuts of beef.
  - a. Make retail cuts of tongue.
  - b. Make retail cuts of heart.
  - c. Make retail cuts of liver.
  - d. Make retail cuts of kidney.
  - e. Make retail cuts of brain.
3. Identify and fabricate cuts of pork.
  - a. Identify carcass break cuts of pork.
  - b. Make retail cuts of ham.
  - c. Make retail cuts of loin.
  - d. Make retail cuts of shoulder (Boston butt and picnic).
  - e. Make retail cuts of side.
4. Identify and fabricate retail variety cuts of pork.
  - a. Make retail cuts of tongue.
  - b. Make retail cuts of liver.
  - c. Make retail cuts of chitterlings.
  - d. Make retail cuts of stomach.
  - e. Make retail cuts of kidneys.
  - f. Make retail cuts of snouts.
5. Identify and fabricate cuts of lamb and goat.
  - a. Identify carcass break cuts of lamb and goat.
  - b. Identify retail cuts of leg.
  - c. Identify retail cuts of loin.
  - d. Identify retail cuts of rib.
  - e. Identify retail cuts of shoulder.
  - f. Identify retail cuts of foreshank and breast.
6. Identify and fabricate cuts of poultry.
  - a. Identify carcass break cuts of poultry.
  - b. Make retail cuts of breast quarter.
  - c. Make retail cuts of leg quarter.
  - d. Make retail cuts of back quarter.

7. Identify variety cuts of poultry.
  - a. Identify retail cuts of heart.
  - b. Identify retail cuts of liver.
  - c. Identify retail cuts of gizzard.
  - d. Identify retail cuts of neck.
8. Identify retail cuts of fish.
9. Identify and fabricate cuts of wild game.
  - a. Make cuts of top round.
  - b. Make cuts of bottom round.
  - c. Make cuts of tip roast.
  - d. Make cuts of eye round.
  - e. Make cuts of loin eye.
  - f. Make cuts of ribs.
  - f. Debone front shoulders.
10. Prepare wild game specialty products.
  - a. Prepare various sausage products.
  - b. Prepare ground products.
  - c. Prepare jerky products.
11. Observe the automated processing of various types of meat.
  - a. Observe step-by-step procedures for the automated slaughtering and fabrication processing of beef, pork, lamb, poultry, and fish.
  - b. Observe step-by-step procedures for the automated canning processing of beef, pork, poultry, and fish.
12. Explain quality and yield grades for beef and determine classifications of beef.
  - a. Explain quality grades for beef.
  - b. Explain yield grades of beef.
  - c. Determine classification of beef.
  - d. Estimate amount of kidney fat, pelvic fat, and age.
  - e. Estimate amount of marbling in a ribeye.
13. Explain quality grades and determine classification of pork.
  - a. Explain quality grades for pork.
  - b. Determine classification of pork.
14. Explain quality and yield grades for lamb and determine classifications of sheep.
  - a. Explain quality grades of lamb.
  - b. Explain yield grades of lamb.
  - c. Determine classification of sheep.
15. Explain grades in poultry.
  - a. Explain grades of poultry.
  - b. Discuss poultry classifications.
16. Explain and demonstrate meat curing and smoking processes.
  - a. Define curing, smoking, and sausage making terms.
  - b. Describe the functions of curing and smoking.
  - c. Describe meat curing ingredients and calculate correct amount of each.
  - d. Explain methods of meat curing.
  - e. Identify and use equipment used in smoking and curing process.
  - f. Cure bacon in brine solution.
  - g. Cure jowl in brine solution.

- h. Pump shoulders.
  - i. Pump hams.
  - j. Pump loin.
  - k. Smoke shoulder, ham, loins, bacon, and jowls in smoker.
17. Explain and demonstrate sausage making.
- a. Mix and grind sausage with cure and seasoning.
  - b. Read a salinometer.
  - c. Prepare a brine solution.
  - d. Stuff sausage in casing.
  - e. Smoke sausage in smoker.
18. Investigate new and emerging technologies, practices, trends, and issues associated with Food Products (Meats).
- a. Prepare a report on a new and emerging technology associated with Food Products (Meats).
  - b. Prepare a report on a current trend or issue associated with Food Products (Meats).
19. Complete school-to-careers activities related to Food Products (Meats).
- a. Participate in a school-to-careers activity (shadowing, mentoring, career fair, etc.) related to Food Products (Meats).
  - b. Investigate educational opportunities related to Food Products (Meats) at the postsecondary level.
  - c. Describe national standards and certification/licensing procedures related to Food Products (Meats).
  - d. Describe the role of trade organizations, associations, and unions as related to Food Products (Meats).
20. Demonstrate related academic skills and workplace skills associated with Food Products (Meats).
- a. Complete a cooperative project (paper, presentation, or demonstration) associated with an academic subject and Food Products (Meats).
  - b. Practice human relations skills (team participation, client/customer service, leadership, negotiation, working with culturally diverse groups, etc.) related to Food Products (Meats).
  - c. Research work ethics and employer expectations of employees in Food Products (Meats).
21. Investigate the concepts of quality assurance as related to Food Products (Meats).
- a. Describe quality concepts and methods for measuring quality related to Food Products (Meats).
  - b. Apply quality concepts in the Food Products (Meats) laboratory.
22. Examine trends and changes related to Food Products (Meats) and global economic factors.
- a. Define and discuss the concept of global economics and competition.
  - b. Describe global economic factors and competition as related to Food Products (Meats).
  - c. Identify regions and other countries which compete in Food Products (Meats).

## **Program Description**

### **Introduction to Agriscience**

Introduction to Agriscience serves as an introduction to the science of agriculture and will provide a solid foundation for advanced agriscience classes or for additional agriculture/science classes. Students will be introduced to agricultural science topics including biotechnology, animal science, mechanical technology, food science, plant science, environmental and natural resources, and entomology. These concepts are taught through classroom and laboratory instruction and applications such as the Supervised Agricultural Experience Program (SAE) and FFA Career Development Activities. This program will utilize the problem solving method of instruction and will rely upon the agricultural information systems, including the Internet. Leadership, citizenship, and cooperation skills are taught through participation in FFA activities. The FFA is an intra-curricular vocational student organization designed to provide a learning laboratory for the implementation of this curriculum.

Introduction to Agriscience is intended to be a one-year course of study. Students completing the course will receive one Carnegie unit for science and an additional 0.5 Carnegie unit for completion of the Supervised Agricultural Experience (SAE).

Industry standards referenced are from the *Career Cluster Resources for Agriculture, Food, and Natural Resources*, National Association of State Directors of Career and Technical Education.

## Course Outline

### Introduction to Agriscience

Course CIP Code: 02.9990

**Course Description:** Introduction to Agriscience is the entry level course of the secondary Agriscience program. Students in Introduction to Agriscience will gain foundation competencies related to agriscience opportunities and careers, safety and the scientific method, human relations/leadership/FFA activities, supervised agricultural experience (SAE), biotechnology, animal science, mechanical technology, food and fiber science, plant science, environmental and natural resources, and entomology. (1-1½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Introduction to Agriscience Opportunities and Careers	10
2	Introduction to Agriscience Lab Safety and the Scientific Method	10
3	Human Relations/Leadership/FFA Activities	10
4	Supervised Agricultural Experience (SAE) in Agriscience	10
5	Introduction to Biotechnology	9
6	Basic Principles of Animal Science	13
7	Mechanical Technology in Agriscience	8
8	Principles of Food Science	8
9	Principles of Plant Science	9
10	Principles of Environmental and Natural Resources	9
11	Principles of Entomology	9

**Course Name:** Introduction to Agriscience

**Course CIP Code:** 02.9990

### **Competencies and Suggested Objectives**

1. Introduce concepts and terms associated with agriculture, science, and agriscience.
2. Investigate the major areas of agriculture.
  - a. Examine major areas of agriculture: agricultural processing, agricultural production, agricultural mechanics, agribusiness/supplies and services, forestry, natural resources, horticulture, entomology, aquaculture, animal science, and plant science.
  - b. Describe the importance of the areas in society.
  - c. Discuss the economic impact of the areas in local, state, national, and global economies.
3. Connect major sciences supporting agriscience.
  - a. Examine concepts of biology, chemistry, biochemistry, physical sciences, and biotechnology.
  - b. Relate the use of concepts of pure science to the use of concepts of agriscience.
4. Investigate current trends occurring in agriscience.
  - a. Investigate precision agriculture.
  - b. Investigate niche farming, such as organic farming and alternative animal agriculture.
  - c. Investigate animal tracking.
  - d. Investigate country of origin labeling.
5. Examine the opportunities for careers in agriscience.
6. Demonstrate job seeking skills.
  - a. Conduct an Internet search for employment in a selected agricultural occupation.
  - b. Develop a resume.
  - c. Prepare a job application and cover letter.
  - d. Participate in a role-play interview.
7. Analyze the basic rules of safety in the agriscience laboratory.
  - a. Discuss safe and proper use of chemicals, heat and fire, laboratory equipment, specimens and animals, and electrical equipment.
  - b. Utilize procedures for reporting an accident.
  - c. Examine the “Hazardous Communications Acts” and the “Worker Protection Act” as applied to agricultural occupations.
  - d. Illustrate the use of a Materials Safety Data Sheet (MSDS).
8. Demonstrate all safety equipment in the agriscience laboratory.
9. Practice safety concepts in laboratory activities.
  - a. Use appropriate precautions when working with electrical applications, fire, poisons, and gas.
  - b. Protect hands and eyes.
  - c. Wear proper clothing for protection.
  - d. Safely work with animals and plants.
  - e. Take steps to prevent explosion danger.
10. Examine terms and concepts associated with the scientific method.

11. Describe each step of the scientific method.
  - a. Identify the problem.
  - b. Gather data.
  - c. Formulate possible solutions.
  - d. Implement the preferred solutions.
  - e. Evaluate the results.
12. Apply the scientific method.
  - a. Identify the problem or question to be answered.
  - b. Gather data related to the problem or question.
  - c. Formulate possible solutions.
  - d. Implement one or a combination of several solutions.
  - e. Evaluate the results and pursue further research as needed.
13. Discuss concepts related to leadership.
  - a. Describe leadership.
  - b. Describe traits of a good leader such as integrity, knowledge, courage, tactfulness, enthusiasm, unselfishness, and loyalty.
  - c. Practice acceptable manners in appropriate places, including introductions, greetings, table manners, and telephone manners.
14. Investigate the FFA organization.
  - a. Describe the history of FFA.
  - b. Contrast degrees of membership.
  - c. State the creed.
  - d. Demonstrate official dress.
  - e. Investigate the emblem and its symbols.
15. Explain opportunities for leadership development through the FFA.
  - a. Describe contests and awards programs, including proficiency awards and state and American degrees.
  - b. Participate in personal development seminars.
  - c. Participate in leadership activities and/or leadership conferences and conventions.
  - d. Describe national and international exchange programs.
  - e. Plan for educational experience with industry.
  - f. Determine opportunities for participation in personal and community development programs.
16. Participate in parliamentary procedure.
  - a. Define parliamentary terms.
  - b. Introduce a motion.
  - c. Debate amendments.
  - d. Utilize different methods of voting.
  - e. Discuss taps of the gavel.
17. Describe the purposes and requirements of the SAE.
  - a. Establish objectives for the SAE.
  - b. Determine the availability of time and money to invest.
  - c. Select a system of record keeping.
  - d. Determine benefits of participation in an SAE.
  - e. Determine types of SAE programs.
18. Develop a long-range personal plan for the SAE.
  - a. Set long-range goals.

19. Develop a short-range personal plan.
  - a. Set short-range goals.
20. Complete a training agreement for an SAE.
  - a. Establish requirements of student, parents, supervisor, and/or employer.
21. Describe agricultural record keeping for an SAE.
  - a. Determine types of records to keep.
  - b. Describe how to maintain various systems of record keeping.
22. Maintain agricultural records for an SAE.
  - a. Prepare income and expense records.
  - b. Prepare inventory records.
  - c. Compute enterprise summaries.
  - d. Maintain placement records.
  - e. Summarize the SAE program.
  - f. Maintain leadership activity records.
  - g. Compute a net worth statement.
23. Explain the basic principles of heredity.
  - a. Describe the role of genes and chromosomes in heredity.
  - b. Explain the functions of DNA and RNA in heredity.
  - c. Describe the process of cell division in reproduction.
  - d. Discuss mutations, genetic disease, and birth defects in the process of inheritance.
  - e. Calculate a simple problem demonstrating inheritance of dominant and recessive traits.
24. Discuss terms and concepts related to biotechnology.
  - a. Define terms related to biotechnology.
  - b. Identify improvements of animals and plants made possible through biotechnology.
  - c. Describe emerging issues associated with biotechnology.
  - d. Investigate issues of bio-security which producers of plants and animals should be applying to protect their products from contamination or destruction.
  - e. Describe the practice of animal and plant integration used in disease and insect control.
25. Explain historical events in biotechnology.
  - a. Describe early discoveries before 1800.
  - b. Describe basic scientific discoveries 1800 to 1900.
  - c. Describe discoveries in molecular biology.
  - d. Describe the age of biotechnology (1977 to present).
26. Analyze DNA properties.
  - a. Match DNA to properties.
  - b. Observe crop varieties engineered to resist insects, disease, and chemical damage.
  - c. Test crop varieties engineered to resist insects, disease, and chemical damage.
27. Define terms associated with animal science.
28. Investigate major agricultural species of animals and their economic contributions.
  - a. Discuss production of beef and dairy cattle, sheep, goats, swine, poultry, horses, and aquatic species.
  - b. Examine their economic impact at the local, state, national, and global levels.
29. Examine the internal and external body parts of major agricultural species of animals.

30. Investigate economic and practical considerations of livestock production.
  - a. Identify management systems of animal production used with cattle, swine, poultry, and aquacultural animals.
  - b. Describe types and breeds of livestock.
  - c. Describe feeds and feeding practices required for cattle, sheep, swine, horses, and poultry.
  - d. Describe the importance of animal health in livestock production.
  - e. Describe the importance of factors contributing to cost of production of livestock.
31. Define terms associated with mechanical technology in agriscience.
32. Use precision measuring devices to determine mass, weight, and volume.
  - a. Demonstrate use of a balance.
  - b. Demonstrate use of a scale.
  - c. Demonstrate use of a graduated cylinder.
  - d. Demonstrate use of standard measuring devices including rulers, tape measures, micrometers, dividers, and protractors.
33. Identify and calculate mechanical advantages of six simple machines including lever, inclined plane, wheel, fulcrum, pulley, and axle.
  - a. Describe six simple machines including lever, inclined plane, wheel, fulcrum, pulley, and axle.
  - b. Calculate mechanical advantages of six simple machines including lever, inclined plane, wheel, fulcrum, pulley, and axle.
  - c. Demonstrate an example of mechanical advantage by using simple machines.
34. Investigate principles of electricity.
  - a. Explain the differences between alternating current (AC) and direct current (DC).
  - b. Explain the principles of series and parallel circuits.
  - c. Explain the characteristics of insulators (rubber, plastic, and ceramic) and conductors (copper and aluminum).
35. Examine the economic scope of major areas of the food industry.
  - a. Define terms associated with food science such as producer, harvester, processor, distributor, wholesaler, retailer, and consumer.
  - b. Investigate the effect of various areas of the food industry on the local, state, national, and global economy.
36. Investigate processes for harvesting plants and animals for food.
37. Describe techniques used in marketing food for retail sale.
  - a. Describe the marketing process for food from producer to consumer.
  - b. Demonstrate techniques used in preparing and displaying food for retail sale.
38. Examine food products and processing.
  - a. Explain methods of processing, preserving, and storing foods.
  - b. Identify the wholesale cuts of major agricultural species of animals.
  - c. Describe some of the factors of profitability in processing of animal carcasses including processing yield, shrinkage, and fat vs. lean content.
39. Explain principles of supply and demand in food production.
40. Examine concepts related to plant science.
  - a. Define terms related to plant science.
  - b. Investigate various factors affecting plant growth.
41. Investigate major structural parts of plants including roots, stems, and leaves.
  - a. Diagram the parts of plants.

- b. Explain the functions of various parts of plants.
- 42. Explain the important plant growth and food production processes.
  - a. Describe photosynthesis.
  - b. Describe transpiration.
  - c. Describe respiration.
  - d. Investigate principles of photosynthesis, transpiration, respiration, and absence of plant nutrients.
- 43. Describe various methods of plant reproduction.
  - a. Contrast annual, perennial, and biennial plant life cycles.
  - b. Describe the functions of complete and incomplete flowers.
  - c. Discuss means of sexual and asexual reproduction.
  - d. Describe principles of plant pollination.
- 44. Define terms related to environmental and natural resources including air, water, and soil.
- 45. Explore the basic concepts of natural resource conservation and management.
  - a. Classify renewable and non-renewable natural resources.
  - b. Discuss the concept of sustainability as related to natural resources and the environment.
- 46. Investigate properties of soil.
  - a. Locate the A, B, and C horizons.
  - b. Identify coarse, medium, and fine textured soil.
  - c. Conduct soil analysis testing.
- 47. Explore issues related to air and water quality, conservation, and preservation.
  - a. Discuss the sources of water and potential threats to each source.
  - b. Discuss sources of air pollution and precautions that can be taken to reduce or prevent pollution.
  - c. Explore ways in which agricultural enterprises protect and enhance air and water quality.
- 48. Define terms related to entomology.
- 49. Describe the importance of entomology to agriculture.
  - a. Identify beneficial insects and their importance.
  - b. Identify harmful insects and their effects.
- 50. Classify insects scientifically based on their morphology.
  - a. Identify the parts of an insect including head, antenna, thorax, abdomen, wings, and legs.
  - b. Use scientific classification to identify insects by their order.
- 51. Explain the growth processes of insects.
  - a. Describe gradual (incomplete) metamorphosis.
  - b. Describe complete metamorphosis.
- 52. Discuss an integrated pest management plan.

## BUSINESS AND COMPUTER TECHNOLOGY

### **Program Description Computer Programming Technology**

The Computer Programming Technology program prepares students for careers in computer programming using programming languages such as: Visual Basic, C++, and HTML. Students also gain hardware and networking knowledge, training in web design, job procurement, and interviewing techniques.

Industry standards referenced are from the *Skill Standards for Information Technology* published by the Northwest Center for Emerging Technologies and from the *Internet and Computing Core Certification (IC<sup>3</sup>) Standards* published by Certiport. Program competencies are designed to prepare students for A+, Network+, and IC<sup>3</sup> certifications. Additional research data used in the development of this publication were collected from a review of related literature and from surveys of local experts in business, industry, and education.

## Course Outline

### Computer Programming Technology I

Course CIP Code: 07.0390

**Course Description:** Computer Programming Technology I is the entry level course of the secondary Business and Computer Data Processing program. Students in Computer Programming Technology I will gain foundation competencies related to Orientation, Visual Basic Language Syntax and Programming Applications, Multimedia Applications, Introduction to Computer Hardware, Operating Systems, and HTML Programming. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Orientation	40
2	Introduction to Computer Hardware	30
3	Operating Systems	40
4	Visual Basic .NET Language Syntax and Programming Applications	50
5	Multimedia Applications	20
6	HTML Programming	50

### Computer Programming Technology II

Course CIP Code: 07.0391

**Course Description:** Course Description: Computer Programming Technology II is the advanced level course of the secondary Business and Computer Data Processing program. Students in Computer Programming Technology II will gain advanced competencies related to Network Concepts, C++ Language Syntax and Programming Applications, Workplace Skills, and Web Design. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Preparing for a 21 <sup>st</sup> Century Workforce	25
2	Network Concepts	40
3	C++ Language Syntax and Programming Applications	90
4	Web Design	20

**Course Name:** Computer Programming Technology I

**Course CIP Code:** 07.0390

### **Competencies and Suggested Objectives**

1. Research educational, occupational, and leadership opportunities in Computer Programming Technology.
  - a. Review student rules and regulations for the local school.
  - b. Compare and contrast classroom, school, and industry rules and regulations.
  - c. Investigate career opportunities and emerging technologies in Computer Programming Technology.
  - d. Update the students' career and educational plans.
  - e. Identify and describe leadership opportunities available from student youth organizations in the school and community.
2. Apply safety procedures in the computer classroom and lab.
  - a. Discuss the proper classroom and personal safety procedures to include fire extinguishers, electrical, clothing, jewelry, eye protection, etc.
  - b. Care for and use computer hardware correctly.
  - c. Handle diskettes and CDs correctly.
  - d. Explore potential health hazards when working on computer equipment.
  - e. Examine PC security procedures.
3. Describe legal implications related to the computer industry.
  - a. Discuss software copyright issues.
  - b. Examine software licensing.
  - c. Outline Internet ethics and policies.
4. Publish and interact with peers, experts, and other audiences using telecommunications.
  - a. Research safety issues related to telecommunications and the Internet.
  - b. Develop personal safety guidelines that will be used when using telecommunications and the Internet.
  - c. Use browsers, search engines, and e-mail.
  - d. Post information to discussion boards, blogs, wikis, etc.
  - e. Join and participate in appropriate, supervised listservs.
  - f. Use an appropriate, supervised chat room to communicate with peers, experts, and other approved audiences.
  - g. Evaluate Web page design techniques.
5. Evaluate computer hardware and software issues.
  - a. Differentiate between hardware and software in a computer environment.
  - b. Classify computers according to form factors.
  - c. Identify various pieces of hardware and the function(s) performed by each.
  - d. Identify and troubleshoot potential problems with peripherals.
6. Resolve various computer issues.
  - a. Identify and describe the internal components of a computer.
  - b. Identify and describe the various peripheral components of a computer.
  - c. Install and configure internal components.
  - d. Install and configure peripheral components.

7. Troubleshoot and perform small computer repair.
  - a. Brainstorm harmful external influences of computer equipment.
  - b. Perform preventive maintenance procedures for a hard drive.
  - c. Examine causes, treatment, and prevention of viruses.
  - d. Perform small computer repair to include replacing drives, adding RAM, and replacing power supply.
8. Distinguish among types of basic logic to include IO, processing, memory, and storage.
  - a. Identify terms associated with basic logic.
9. Use various functions of an operating system.
  - a. Define and illustrate terms related to the operating system.
  - b. Summarize the components of an operating system (Input, Processing, Storage, and Output).
10. Compare the features of various computer operating systems.
  - a. Discuss the difference between network operating systems and individual PC operating systems.
  - b. Compare and contrast operating systems.
11. Install and configure an operating system.
  - a. Demonstrate installation utilizing CD, floppy, download, etc.
  - b. Perform various configuration procedures.
  - c. Perform troubleshooting procedures.
12. Create and present a presentation/project on emerging technology, practices, trends, and issues associated with computer technology.
  - a. Research emerging technologies, practices, trends, and issues associated with computer technology.
  - b. Evaluate emerging technologies, practices, trends, and issues associated with computer technology.
13. Use operating systems, programming languages, and application software.
  - a. Research programming languages.
  - b. Compare and contrast different programming languages.
  - c. Research application software.
  - d. Compare and contrast different types of application software.
14. Apply basic networking concepts with Windows.
  - a. Identify basic networking terminology.
  - b. Use networking capabilities of Windows.
  - c. Apply Internet concepts and capabilities.
15. Discover the program development cycle to include input/output, processing, and storage.
  - a. Use the program development cycle to run, debug, and produce printed reports for sample programs.
  - b. Produce an original program to input data, process data, and output a printed report.
16. Classify computational and logical operations.
  - a. Prepare programs that use arithmetic operations (i.e., addition, subtraction, multiplication, division, and/or exponentiation).
  - b. Produce programs that use relational operators.

17. Assemble interactive programs that include all topics discussed to this point.
  - a. Prepare programs which require interaction among computer, program, and user.
18. Generate programs which execute controlled loops.
  - a. Differentiate among different types of loops (e.g., while loop, for loop, do while loop).
19. Explore and use techniques for processing arrays.
  - a. Develop programs which use arrays.
  - b. Use loops with one and two dimensional arrays.
20. Experiment with multimedia applications.
  - a. Define terminology related to multimedia applications.
  - b. Create multimedia applications using software and hardware to record sounds, capture video, and integrate these with text.
21. Construct a multimedia application.
22. Use a Web page adhering language.
  - a. Research career opportunities related to Web design.
  - b. Define terminology related to Web page adhering languages.
  - c. Critique page layouts.
  - d. Design the visual storyboard.
  - e. Prepare text layouts.
  - f. Construct a Web page.
  - g. Evaluate Web page adhering language applications.
23. Generate a graphic design project.
  - a. Investigate the technology related to creating and transferring visual graphics.
  - b. Practice using the technology related to visual graphics.
  - c. Generate a graphic design project.

**Course Name:** Computer Programming Technology II  
**Course CIP Code:** 07.0391

### **Competencies and Suggested Objectives**

1. Research career opportunities and employment.
  - a. Search resources for a job opening in computer programming and/or related area.
  - b. Prepare, in an acceptable format, an application letter, a résumé, and a follow-up letter using word processing software.
  - c. Integrate an application using word processing, database, and/or spreadsheet to simulate sending letters of application and résumés to various potential employers.
  - d. Conduct himself/herself appropriately on a mock job interview, to include completing a job application.
  - e. Visit an industry/computer center and analyze the hardware/software usage and needs, the educational training for personnel, the tasks performed by personnel, and the future outlook for those jobs.
2. Examine network models.
  - a. Define terminology related to networks.
  - b. Identify hardware components needed to network two or more computers such as a network interface card, various cables, hubs, switches, and server.
  - c. Identify the various operating systems for networks such as Novell, Windows NT, Windows XP, Windows Vista, Unix, Linux, and Mac OS.
3. Relate characteristics, theories, and components of networks.
  - a. Discuss examples of recognized network topology.
  - b. Compare network topology.
  - c. Discuss protocols.
  - d. Discuss network models (OSI v. DOD).
4. Compare transmission media to include coax, twisted pair, fiber optics, and wireless.
  - a. Demonstrate cabling termination techniques and test connections.
5. Manage a network using directory services.
  - a. Create user accounts and edit user properties according to best practices for assigning and modifying rights, password creation and expiration, and security groups.
6. Demonstrate various telecommunications activities.
  - a. Distinguish between ethical and unethical use of telecommunications.
  - b. Transmit and receive specified information.
7. Research current telecommunications trends and issues.

Develop a timeline showing the history of telecommunications.
8. Analyze the structure of the C++ language.
  - a. Define terms associated with computer programming technology.
  - b. Construct an algorithm for computer programming technology.
  - c. Develop a basic understanding of the C++ programming language.
9. Exhibit screen output using the C++ language.
10. Classify variables and constants.
  - a. Distinguish among variable types.
  - b. Identify constants.

11. Analyze the order of operations for mathematical equations
  - a. Apply the fundamental operators.
  - b. Prepare a program that counts.
  - c. Test and debug programs that use the order of operations.
12. Exhibit screen input.
  - a. Identify strings.
  - b. Produce screen I/O.
13. Illustrate the use of decision-making.
  - a. Produce programs in which comparisons are to be made.
  - b. Select structures.
14. Create loops.
  - a. Develop the for loop.
  - b. Design the while loops.
15. Investigate trends and mark-up languages related to advanced Web page design.
  - a. Explore emerging Web software technologies.
  - b. Compare languages related to Web page design.
16. Evaluate Web page designs.
  - a. Use visual graphics tools.
  - b. Use audio/visual components.
  - c. Critique various Web pages.
17. Design and maintain a Web page related to a specific project. (Ongoing)
  - a. Develop a Web page and associated links.
  - b. Use new technologies to maintain the Web page.

## **Program Description**

### **Computer Systems Technology**

The Computer Systems Technology Program is designed to provide the basic foundation, skills, and knowledge for computer networking, applications, and support. Students will receive the skills necessary to prepare for certification exams and will learn how to develop, support, and integrate computing systems; acquire network planning and management skills; and provide technical support. The program will provide hands-on experience in computer systems support and skill in network setup and maintenance.

Industry standards referenced are from the *Skill Standards for Information Technology* published by the Northwest Center for Emerging Technologies. Program competencies are designed to prepare students for A+, Network+, and IC<sup>3</sup> certifications. Additional research data used in the development of this publication were collected from a review of related literature and from surveys of local experts in business, industry, and education.

## Course Outline

### Computer Systems Technology I

Course CIP Code: 47.0205

**Course Description:** Computer Systems Technology I is an entry level course. Students in Computer Systems Technology I will gain foundation competencies related to basic computer theory, hardware, operating systems and data communications. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Orientation	40
2	Introduction to Computer Hardware	30
3	Basic Electricity and Data Communications	45
4	Operating Systems	40
5	Assembly, Installation, and Diagnosis	50
6	Preparing for a 21 <sup>st</sup> Century Workforce	25

### Computer Systems Technology II

Course CIP Code: 47.0206

**Course Description:** Computer Systems Technology II will provide foundation competencies related to networking theory for local and wide area network connectivity. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Orientation	15
2	Web Design	20
3	Network Concepts	40
4	Local Area Network	40
5	Wide Area Network	40
6	Network Management	30
7	School-to-Careers	20

**Course Name:** Computer Systems Technology I  
**Course CIP Code:** 47.0205

1. Research educational, occupational, and leadership opportunities in Computer Systems Technology.
  - a. Review student rules and regulations for the local school.
  - b. Compare and contrast classroom, school, and industry rules and regulations.
  - c. Investigate career opportunities and emerging technologies in Computer Systems Technology.
  - d. Update the students' career and educational plans.
  - e. Identify and describe leadership opportunities available from student youth organizations in the school and community.
2. Apply safety procedures in the computer classroom and lab.
  - a. Discuss the proper classroom and personal safety procedures to include fire extinguishers, electrical, clothing, jewelry, eye protection, etc.
  - b. Care for and use computer hardware correctly.
  - c. Handle diskettes and CDs correctly.
  - d. Explore potential health hazards when working on computer equipment.
  - e. Examine PC security procedures.
3. Describe legal implications related to the computer industry.
  - a. Discuss software copyright issues.
  - b. Examine software licensing.
  - c. Outline Internet ethics and policies.
4. Publish and interact with peers, experts, and other audiences using telecommunications.
  - a. Research safety issues related to telecommunications and the Internet.
  - b. Develop personal safety guidelines that will be used when using telecommunications and the Internet.
  - c. Use browsers, search engines, and e-mail.
  - d. Post information to discussion boards, blogs, wikis, etc.
  - e. Join and participate in appropriate, supervised listservs.
  - f. Use an appropriate, supervised chat room to communicate with peers, experts, and other approved audiences.
  - g. Evaluate Web page design techniques.
5. Evaluate computer hardware and software issues.
  - a. Differentiate between hardware and software in a computer environment.
  - b. Classify computers according to form factors.
  - c. Identify various pieces of hardware and the function(s) performed by each.
  - d. Identify and troubleshoot potential problems with peripherals.
6. Resolve various computer issues.
  - a. Identify and describe the internal components of a computer.
  - b. Identify and describe the various peripheral components of a computer.
  - c. Install and configure internal components.
  - d. Install and configure peripheral components.
7. Troubleshoot and perform small computer repair.
  - a. Brainstorm harmful external influences of computer equipment.
  - b. Perform preventive maintenance procedures for a hard drive.

- c. Examine causes, treatment, and prevention of viruses.
  - d. Perform small computer repair to include replacing drives, adding RAM, and replacing power supply.
8. Distinguish among types of basic logic to include IO, processing, memory, and storage.
  - a. Identify terms associated with basic logic.
9. Discuss voltage and current.
  - a. Discuss Ohm's Law and the power formula.
  - b. Explain alternating current.
  - c. Examine direct current.
10. Explain UPS function and requirements for the computer.
  - a. Determine power requirements for the UPS.
  - b. Describe the functions of the surge protector.
11. Troubleshoot transmission media.
  - a. Examine optics.
  - b. Examine copper wire.
  - c. Examine wireless/remote access.
  - d. Examine connectors.
  - e. Explore circuits.
12. Use various functions of an operating system.
  - a. Define and illustrate terms related to the operating system.
  - b. Summarize the components of an operating system (Input, Processing, Storage, and Output).
13. Compare the features of various computer operating systems.
  - a. Discuss the difference between network operating systems and individual PC operating systems.
  - b. Compare and contrast operating systems.
14. Install and configure an operating system.
  - a. Demonstrate installation utilizing CD, floppy, download, etc.
  - b. Perform various configuration procedures.
  - c. Perform troubleshooting procedures.
15. Create and present a presentation/project on emerging technology, practices, trends, and issues associated with computer technology.
  - a. Research emerging technologies, practices, trends, and issues associated with computer technology.
  - b. Evaluate emerging technologies, practices, trends, and issues associated with computer technology.
16. Use operating systems, programming languages, and application software.
  - a. Research programming languages.
  - b. Compare and contrast different programming languages.
  - c. Research application software.
  - d. Compare and contrast different types of application software.
17. Apply basic networking concepts with Windows.
  - a. Identify basic networking terminology.
  - b. Use networking capabilities of Windows.
  - c. Apply Internet concepts and capabilities.

18. Assemble a computer.
  - a. Construct a computer.
  - b. Install additional components.
  - c. Diagnose hardware problems.
19. Install an operating system (OS).
  - a. Install and configure OS software.
  - b. Diagnose OS software problems.
  - c. Upgrade OS from an earlier version to a newer version.
20. Install application, web browser, and virus protection software.
21. Research career opportunities and employment.
  - a. Search resources for a job opening in computer programming and/or related area.
  - b. Prepare, in an acceptable format, an application letter, a resume, and a follow-up letter using word processing software.
  - c. Integrate an application using word processing, database, and/or spreadsheet to simulate sending letters of application and resumes to various potential employers.
  - d. Conduct himself/herself appropriately on a mock job interview, to include completing a job application.
  - e. Visit an industry/computer center and analyze the hardware/software usage and needs, the educational training for personnel, the tasks performed by personnel, and the future outlook for those jobs.

**Course Name:** Computer Systems Technology II

**Course CIP Code:** 47.0206

1. Review educational, occupational, and leadership opportunities in Computer Systems Technology.
  - a. Review student rules and regulations for the local school.
  - b. Investigate career opportunities and emerging technologies in Computer Systems Technology.
  - c. Update the students' career and educational plans.
  - d. Identify and describe leadership opportunities available from student youth organizations in the school and community.
2. Plan and implement an engineering journal/log. (Ongoing)
  - a. Discuss the use and application of journal/log.
  - b. Create and maintain a journal/log.
3. Review safety in the computer classroom and lab.
  - a. Discuss the proper classroom and personal safety procedures to include fire extinguishers, electrical, clothing, jewelry, eye protection, etc.
  - b. Care for and use computer hardware correctly.
  - c. Handle diskettes and CDs correctly.
  - d. Recognize the potential hazards of computer equipment.
  - e. Examine security procedures.
4. Investigate trends and mark-up languages related to advanced Web page design.
  - a. Explore emerging Web software technologies.
  - b. Compare languages related to Web page design.
5. Evaluate Web page designs.
  - a. Use visual graphics tools.
  - b. Use audio/visual components.
  - c. Critique various Web pages.
6. Design and maintain a Web page related to a specific project. (Ongoing)
  - a. Develop a Web page and associated links.
  - b. Use new technologies to maintain the Web page.
7. Examine network models.
  - a. Define terminology related to networks.
  - b. Identify hardware components needed to network two or more computers such as a network interface card, various cables, hubs, switches, and server.
  - c. Identify the various operating systems for networks such as Novell, Windows NT, Windows XP, Windows Vista, Unix, Linux, and Mac OS.
8. Relate characteristics, theories, and components of networks.
  - a. Discuss examples of recognized network topology.
  - b. Compare network topology.
  - c. Discuss protocols.
  - d. Discuss network models (OSI v. DOD).
9. Compare transmission media to include coax, twisted pair, fiber optics, and wireless.
  - a. Demonstrate cabling termination techniques and test connections.

10. Manage a network using directory services.
  - a. Create user accounts and edit user properties according to best practices for assigning and modifying rights, password creation and expiration, and security groups.
11. Demonstrate various telecommunications activities.
  - a. Distinguish between ethical and unethical use of telecommunications.
  - b. Transmit and receive specified information.
12. Research current telecommunications trends and issues.
  - a. Develop a timeline showing the history of telecommunications.
13. Outline the physical aspects of a Local Area Network (LAN).
  - a. Investigate appropriate topology and protocols for the Local Area Network.
  - b. Identify hardware components of the LAN.
  - c. Identify software components of the LAN.
14. Define the logical aspects of the Local Area Network.
  - a. Examine network models.
  - b. Define classes of network addresses and subnetworks.
  - c. Examine routing tables.
15. Establish a LAN.
  - a. Plan and design the LAN.
  - b. Construct the LAN.
16. Discuss the physical components of a Wide Area Network (WAN).
  - a. Examine domains and service providers.
  - b. Identify hardware components of the WAN.
17. Discuss the logical components of and various protocols used in a WAN.
18. Plan and design a WAN and present a proposal.
19. Discuss the diagnostic process of a WAN.
  - a. Investigate hardware-based management tools.
  - b. Explore commercial management packages.
20. Investigate network security.
  - a. Define terms related to security.
  - b. Identify devices related to security.
  - c. Investigate security software and common security breaches and vulnerabilities.
21. Explore network operating systems.
  - a. Practice using utilities to manage the network.
  - b. Set up users and security.
22. Complete school-to-careers activities related to Computer Systems Technology.
  - a. Participate in a school-to-careers activity (shadowing, mentoring, simulation, career fair, etc.).
  - b. Investigate educational opportunities related to Computer Systems Technology.
  - c. Describe national standards and certification/licensing procedures related to Computer Systems Technology.
  - d. Describe the role of trade organizations, associations, and unions as related to Computer Systems Technology.
23. Complete a final project.
  - a. Demonstrate competencies gained from Computer Systems Technology II.

## **FAMILY AND CONSUMER SCIENCES AND RELATED TECHNOLOGY**

### **Program Description Design Technology for Fashion and Interiors**

The Secondary Design Technology for Fashion and Interiors program is designed to prepare students for employment or postsecondary course work in the field of design with emphasis on fashion and interiors. For students interested in fashion and interior design, this program will provide basic occupational skills necessary for continuing education or careers in fashion and interiors to include fashion design, buyers for retail fashion, fashion merchandising and sales, home and home furnishing design, home furnishing manufacturing and sales, and textile or fabric design and sales. Although this program focuses on fashion and interior design, the fundamentals taught can be applied to many other areas and occupations. The basic principles and elements of design are embedded throughout the curriculum. Once a student captures the basic principles and elements of design, that knowledge can be applied to other occupations including furniture, floral, landscaping, architecture, and photography.

In addition to technical skills, students will also develop advanced skills in critical thinking, career development, applied academics, basic business practices, and leadership, life and employability skills.

This program is innovative and integrates with vocational programs such as, marketing, business, technology, drafting, and computer graphics. In addition, the curriculum includes academic standards, National Standards for Family and Consumer Sciences, and 21<sup>st</sup> Century skills. The course will provide opportunities for articulation and coordination with postsecondary Fashion, Interior Design, and Merchandising programs.

## Course Outline

### Design Technology for Fashion and Interiors I

Course CIP Code: 20.0301

**Course Description:** This course is the first year of training to prepare an individual for employment or continued education in the fashion or interior design industry. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Orientation	5
2	Introduction to Technology for Design	5
3	The Design Profession	5
4	The Fashion Design Industry	20
5	Principles and Elements of Design	40
6	Textiles, Fibers, and Fabrics	10
7	Fashion Design Fundamentals	40
8	Equipment for Construction	5
9	Basic Construction Techniques	75
10	Fashion Merchandising	20

### Design Technology for Fashion and Interiors II

Course CIP Code: 20.0390

**Course Description:** This course is the second year of training to prepare an individual for employment or continued education in the fashion or interior design industry. (2-2½ Carnegie units, depending upon time spent in the course).

Unit	Title	Hours
1	Orientation	3
2	Introduction to Interior Environments	20
3	The Profession of Interior Design	5
4	Interior Design Fundamentals	35
5	Lighting and Space Planning	20
6	Furnishings, Fabrics, and Background Elements	30
7	Using Technology to Create Designs and Patterns	77
8	Construction of Basic Designs	35

**Course Name:** Design Technology for Fashion and Interiors I

**Course CIP Code:** 20.0301

1. Discuss local school policies, rules, and procedures.
  - a. Identify school and classroom policies, rules, and procedures.
2. Describe the Design Technology for Fashion and Interiors program.
  - a. Describe the goals of the program.
  - b. Identify the program topics to include fashion design, interior design, merchandising, and computer technology.
3. Examine leadership opportunities in Design Technology for Fashion and Interiors.
  - a. Identify leadership opportunities available from student youth organizations in the school and community, including Family, Career, and Community Leaders of America (FCCLA).
  - b. Develop a plan of work for FCCLA activities.
  - c. Describe the personal characteristics of an effective leader.
  - d. Identify leadership and management styles.
4. Identify computer technology used in Design Technology for Fashion and Interiors.
  - a. Describe the use of technology in design.
  - b. Discuss the use of the personal computer, software, printers, plotter, and cameras.
  - c. Demonstrate the proper use and care of technology equipment.
5. Explain the use of computer-aided design in Design Technology for Fashion and Interiors.
  - a. Identify software technology available.
  - b. Discuss the advantages of computer-aided design software in design.
6. Examine career opportunities in the field of design.
  - a. Identify careers in the field of design.
  - b. Identify employment outlook, wages, and working conditions.
  - c. Identify skills, education, and technology skills required for employment.
7. Discuss employability skills.
  - a. Discuss work ethics, interpersonal behaviors, communication.
  - b. Discuss employer expectations.
8. Discuss job-seeking skills.
  - a. Complete job applications and resume.
  - b. Practice interview skills.
  - c. Explain the purpose and importance of a design portfolio.
9. Describe fashion and the fashion industry.
  - a. Define fashion.
  - b. Describe the fashion cycle.
  - c. Identify terms associated with the fashion industry to include the following: fad, fashion, fashion babies, classic, trends, avant-garde, retro, croquis, couture, haute couture, flat (sketch), mood board, presentation board, attire, vintage, ready-to-wear, collections prêt-a-porter.
  - d. Discuss factors that affect fashion.
  - e. Discuss how the Industrial Revolution influenced fashion to include the invention of the sewing machine and the cotton gin, piece-work, mass production, and ready to wear.
  - f. Identify current trade magazines.

10. Discuss today's fashion industry.
  - a. Identify the types of fashion designers.
  - b. Compare haute couture production and prêt-a-porter production.
  - c. Identify leading designers.
11. Discuss the elements of design.
  - a. Identify the elements of design to include color, shape, line, texture, and space.
  - b. Demonstrate the use of the elements of design.
12. Discuss the principles of design.
  - a. Identify the principles of design to include balance, proportion, emphasis, and harmony.
  - b. Demonstrate the use of the principles of design.
13. Discuss the impact of color in design.
  - a. Identify the color principles.
  - b. Identify hue, value, and intensity
  - c. Identify primary and secondary colors.
  - d. Identify warm and cool colors.
  - e. Identify tint and shade.
  - f. Label the color wheel.
  - g. Identify the color schemes.
14. Illustrate color principles in design.
  - a. Explain the principles of color.
  - b. Explain the color schemes.
  - c. Discuss monochromatic, analogous, complementary, split-complementary, triad, and accented neutral colors.
  - d. Develop a visual illustration of a color scheme.
15. Describe the design equation.
  - a. Explain the design equation.
  - b. Illustrate the design equation.
16. Discuss the origin and characteristics of fibers.
  - a. Identify the origins of natural and manufactured fibers.
  - b. Select appropriate fibers for garments.
17. Discuss methods of fabric construction.
  - a. Identify woven fabrics and its construction and discuss its advantages and disadvantages.
  - b. Identify knit fabrics and its construction and discuss its advantages and disadvantages.
18. Discuss the importance of labels.
  - a. Identify the information found on various fabric labels.
19. Discuss the proper selection of clothing.
  - a. Identify body types.
  - b. Discuss the selection of clothing for different body types.
20. Identify the parts that make up a garment to include bodice, sleeves, collar, lapels, skirt, etc.
21. Identify and describe garment styles.
  - a. Identify and describe the various styles of dresses to include sheath, shift, A-line, tent, empire, high waist, dropped waist, blouson, princess, shirtwaist, coatdress, and asymmetrical closing.

- b. Identify and describe the various styles of necklines to include jewel/round, scoop, u-neck, v-neck, square, crew, boat/bateau, cowl, sweetheart, keyhole, halter, and off-the-shoulder.
  - c. Identify and describe the various styles of collars to include the shirt, button-down, convertible, notched, shawl, pointed flat, peter pan, puritan, turtleneck, ruff, mandarin, band, tuxedo, jabot, bow tie, sailor, wing, Chelsea, and sailor.
  - d. Identify and describe the various styles of sleeves to include set-in, raglan, kimono, dolman, sleeveless, cap, short, roll-up, three quarter, long, butterfly, puff, petal, cowl, bishop, angel, bell, leg of mutton, Juliette, peasant, cuff, shirt cuff, French cuff, ruffle, and circular flounce.
  - e. Identify and describe the various styles of shirts to include the dress, sport, polo, western, t-shirt, tank, fitted, tunic, tuxedo, camisole, and Henley.
  - f. Identify and describe the various styles of skirts to include the straight, dirndl, a-line, gathered, yoke, 4-gore, 6-gore, knife-pleated, single front pleat, stitched box pleats, wrap, flared, and circular.
  - g. Identify and describe the various styles of pants to include the flared, straight, tapered, Bermuda shorts, short shorts, knickers, jumpsuit, jeans, leggings, warm-up, culottes, and palazzo/full.
  - h. Identify and describe the various styles of jackets and coats to include the blazer, double-breasted, boxy, fitted, vest, tuxedo, cardigan, bolero, Chanel, safari, bomber/varsity, windbreaker, parka, pea, poncho, trench, polo, chesterfield, wrap, and cape.
22. Discuss garment shapes.
- a. Explain natural, tubular, bell, and full shapes.
23. Create a fashion design.
- a. Create a mood board.
  - b. Sketch a fashion design on a croquis figure illustrating the principles and elements of design.
  - c. Select appropriate fabric swatches for the design.
  - d. Create a flat showing all of the design features and construction details.
24. Identify equipment used in construction.
- a. Identify large and small equipment in the lab.
  - b. Identify the parts of equipment.
  - c. Explain how each piece of equipment will be utilized.
25. Demonstrate the safe and proper use of equipment.
- a. Describe safety procedures for the use of each piece of equipment.
  - b. Discuss maintenance of each piece of equipment.
26. Define terminology associated with basic construction techniques to include the following:
- Grainlines: Lengthwise, crosswise, and bias
  - Selvage
  - Understitching
  - Seam allowance
  - Grading
  - Top stitch
  - Gathering stitch

- Stay stitch
  - Darts
  - Basting
  - Backstitch
  - Slipstitch
27. Interpret and select a pattern, fabric, and notions.
    - a. Determine measurements.
    - b. Select appropriate design.
    - c. Choose a pattern.
    - d. Interpret pattern envelope directions to include pattern symbols.
    - e. Determine the type and amount of fabric and notions required.
    - f. Determine amount of fabric required.
  28. Demonstrate pattern layout, cutting, and marking
    - a. Identify and interpret the pattern guide sheet and pieces.
    - b. Explain separating pattern pieces.
    - c. Select the proper cutting layout on the guide sheet to include pattern view, size, and width of fabric.
    - d. Lay the fabric out, place the pattern pieces, and secure the pattern pieces to the fabric.
    - e. Demonstrate proper cutting techniques.
    - f. Demonstrate marking the fabric based on the pattern piece.
  29. Practice basic construction techniques.
  30. Discuss activities involved in fashion merchandising.
    - a. Define fashion merchandising.
    - b. Distinguish between wholesale and retail.
    - c. Discuss the classifications of retailers.
    - d. Analyze the relationship of customer service, satisfaction, and communication on the success of business.
  31. Demonstrate the use of retail mathematics.
    - a. Calculate the cost of a garment.
    - b. Calculate the mark-up of a garment.
    - c. Calculate the retail price of a garment.
  32. Discuss the role of merchandising in the design industry.
    - a. Discuss the importance of advertising.
    - b. Describe visual merchandising and its impact on consumer purchasing.
    - c. Assemble a visual merchandising presentation.

**Course Name:** Design Technology for Fashion and Interiors II

**Course CIP Code:** 20.0390

1. Review and discuss local school policies, rules, and procedures.
  - a. Review school and classroom policies, rules, and procedures.
2. Review and examine leadership opportunities in Design Technology for Fashion and Interiors.
  - a. Discuss leadership opportunities available from student youth organizations in the school and community, including Family, Career, and Community Leaders of America (FCCLA).
  - b. Develop a plan of work for FCCLA activities.
3. Identify and discuss the broad scope of interior design.
  - a. Define interior design and discuss the responsibilities of an interior designer.
  - b. Differentiate between decorators and designers.
  - c. Identify and discuss the relationship between interior designers and other allied professionals.
  - d. Identify specific career specializations in interior design.
4. Discuss the history of interior design.
  - a. Identify and discuss the basic style categories to include formal traditional, formal modern, informal provincial, informal modern, and eclectic.
5. Identify the steps to becoming an interior designer.
  - a. Examine the educational requirements of an interior designer.
  - b. Identify the work experience required to become an interior designer.
  - c. Identify and discuss the licensing, registration, and continuing education requirements for interior design.
  - d. Identify professional organizations for interior designers.
6. Identify and discuss emerging careers within the field of interior design.
  - a. Discuss the employment outlook for interior designers.
7. Describe the elements of interior design.
  - a. Identify the elements of interior design to include space, line, shape and mass, texture, light, color, and pattern.
  - b. Demonstrate the use of the elements of interior design.
8. Describe the principles of interior design.
  - a. Identify the principles of interior design to include scale and proportion, balance, rhythm, emphasis, and harmony.
  - b. Demonstrate the use of the principles of interior design.
9. Discuss the impact of color in interior design.
  - a. Review the categories of color to include warm, cool, and neutral.
  - b. Review the color wheel.
  - c. Review and discuss the three dimensions of color to include hue, value, and intensity.
  - d. Create color schemes to include achromatic, monotone, monochromatic, analogous, and complementary.
  - e. Discuss the psychological effects of individual colors.
  - f. Identify the interactions between colors and the elements and principles of design to include space, texture, size, proportion, balance, juxtaposition of colors, and light.

- g. Discuss the application of color to interior backgrounds.
  - h. Discuss the selection of a color scheme.
  - i. Describe color forecasting.
  - j. Develop a visual color scheme for interior design.
10. Discuss lighting in interior design.
    - a. Identify natural and artificial light sources.
    - b. Discuss lighting for various areas and activities.
  11. Describe space planning as related to interior design.
    - a. Describe the purpose of the floor plan.
    - b. Discuss space planning for specific rooms.
    - c. Analyze residential floor plans.
  12. Describe the use of furniture and accessories.
    - a. Identify the types of furniture.
    - b. Identify the general classifications of furniture styles.
    - c. Discuss accessories to include functional and decorative.
    - d. Discuss the selection, grouping, and placement of accessories.
  13. Discuss textiles as related to interior design.
    - a. Review natural and manmade fibers.
    - b. Review fabric construction to include woven and non-woven.
    - c. Discuss textile selection for interiors.
  14. Discuss flooring, ceilings, walls, doors, and windows, and window treatments as related to interior design.
    - a. Identify and discuss the types of flooring to include categories of hard and soft flooring.
    - b. Identify and discuss paint and wall coverings.
    - c. Discuss types of window treatments for various windows.
  15. Create an interior design.
    - a. Design a room.
    - b. Create a presentation board of the design.
  16. Demonstrate the basic use of computers and software in the design process.
    - a. Define and discuss the use of computers and software in the design process.
    - b. Demonstrate the use of basic AutoCAD<sup>®</sup> commands to include the straight line, arch, circle, rectangle, zoom, real time, and pan commands.
    - c. Edit using basic editing commands to include copy, move, erase, undo, trim, extend, and mirror.
    - d. Define and demonstrate drawing with precision using polar, ortho, otrack, and osnap.
  17. Demonstrate the use of technology for illustration.
    - a. Identify the types of illustrations used in fashion design to include floats, specification drawings or flats.
    - b. Discuss the use of croquis figures in computer aided design.
    - c. Explain the purpose of a fashion library.
    - d. Illustrate a design using technology.
  18. Demonstrate the creation of surface designs.
    - a. Define and illustrate creative surface design.
    - b. Discuss historic and ethnic influences on creative surface design.

- c. Demonstrate and explain how computer technology can be used to create surface designs.
  - d. Create surface designs using technology.
19. Demonstrate the use of companion software used in the design process.
- a. Explain the basic purpose of ApparelCAD<sup>®</sup> and Instant Designer<sup>®</sup> software.
  - b. Identify the specific commands used in ApparelCAD<sup>®</sup> and Instant Designer.
  - c. Using the companion software, create a fashion design.
20. Demonstrate patternmaking.
- a. Identify and describe technology used in patternmaking.
  - b. Differentiate between printing and plotting a pattern.
  - c. Plot and print patterns.
21. Construct a design.

## HEALTH SCIENCE AND RELATED TECHNOLOGY

### **Program Description** **Adult Short-Term Homemaker**

Homemaker Services are those supportive services provided primarily in the home by a trained homemaker which involve education and/or provision of homemaker tasks in order to assist in strengthening family life, promoting self-sufficiency, and enhancing quality of life. This adult-short term program prepares the individual to assist with general household tasks and basic personal care. Graduates of this 40-hour program will be awarded the Homemaker certificate upon passing the written competency exam administered by the Mississippi Department of Education Office of Vocational Education and Workforce Development.

Industry standards referenced are from the *National Health Care Skill Standards*.

## Course Outline

### Adult Short-Term Homemaker

Course CIP Code: 20.0606

Unit	Title	Hours
1	Fundamentals of Home Care	14
2	Health Care Assisting Concepts and Skills	16
3	Human Needs/Growth and Development	4
4	Nutrition and Homemaker Services	6
TOTAL HOURS		40

**Course Name:** Adult Short-Term Homemaker

**Course CIP Code:** 20.0606

1. Develop employability skills.
  - a. Describe purposes of health care facilities.
  - b. Define the role of the homemaker.
  - c. Maintain personal hygiene.
  - d. Utilize interpersonal communication skills.
  - e. Complete a job application form.
  - f. Explain the role of an applicant in a job interview.
  - g. Discuss job-keeping skills.
  - h. Prepare a cover letter, a résumé, and a letter of resignation.
2. Explain professional ethics, legal responsibility, and client rights.
  - a. Discuss the Code of Ethics.
  - b. Explain the Health Insurance Portability and Accountability Act of 1996 (HIPAA) and list ways to protect client's confidentiality.
  - c. Identify protective services and the Vulnerable Adult Act as related to clients.
  - d. Identify client's rights in all health care settings.
  - e. Discuss state, federal, and Joint Commission of Health Care Organizations regulations.
  - f. Explain legal guidelines for client protective devices.
  - g. Report signs and symptoms of client abuse/neglect.
3. Recognize safety precautions and procedures.
  - a. Identify personal safety precautions.
  - b. Describe accident prevention guidelines.
  - c. Discuss procedures for dealing with safety hazards.
  - d. Report product and equipment defects.
  - e. Discuss the safe use of oxygen in the home setting.
  - f. Describe client safety in electrical and fire emergencies.
  - g. Identify safety guidelines for client protective devices.
  - h. Obtain CPR American Heart Saver Certification.
4. Use communication and observation skills in the home care environment.
  - a. Utilize communication skills.
  - b. Identify communication techniques with special needs clients.
  - c. Explain the importance of responding to client's request for assistance in a timely manner.
  - d. Assist client with reality orientation support.
  - e. Report pertinent client observations.
  - f. Record pertinent client observations.
  - g. Demonstrate the use of medical references to spell medical terms correctly.
5. Utilize OSHA regulations.
  - a. Utilize principles of medical asepsis and infection control.
  - b. Adhere to standard/universal precautions.
  - c. Relate standard/universal precautions to the transmission of infectious diseases including HIV, AIDS, HAV, HBV, TB, and MRSA.
  - d. Demonstrate hand washing technique.
  - e. Demonstrate donning and removing disposable gloves.

- f. Clean washable supplies using pertinent regulatory guidelines including OSHA standards.
- g. Follow prescribed isolation techniques.
- h. Dispose of contaminated material according to approved policy.
- i. Assist with instruction of patient/family in medical asepsis/isolation techniques.
6. Maintain client's personal care setting.
  - a. Demonstrate unoccupied and occupied bed making skills.
  - b. Maintain aesthetic environment.
7. Assist with lifting, moving, and transporting clients.
  - a. Utilize principles of body mechanics.
  - b. Position patient in bed or chair.
  - c. Turn and reposition client in bed or chair.
  - d. Assist patient in ambulation.
  - e. Transfer patient to and from bed and chair.
  - f. Transfer patient using special devices.
  - g. Transport patient by wheelchair.
  - h. Assist client/family in use of assistive devices.
8. Assist with personal care skills.
  - a. Provide patient privacy.
  - b. Assist with dressing/undressing client.
  - c. Assist with basic activities of daily living.
  - d. Assist with toileting.
  - e. Record and report pertinent observations.
9. Explain physical and emotional needs throughout the lifespan.
  - a. Identify client's basic physical and emotional needs.
  - b. Discuss actions to meet patient's physical and emotional needs.
  - c. Describe the stages of grief.
  - d. Discuss care of the dying patient.
10. Discuss responsibilities of a homemaker's role within a family.
  - a. Recognize reasons that family structure and function are changing in today's society.
  - b. Become aware of the homemaker's role as she/he enters to work within a family unit.
  - c. Describe cultural diversity and religious difference.
11. Explain nutrition and hydration needs of all clients.
  - a. Identify basic nutritional needs for all age groups.
  - b. Develop a menu using the Food Guide Pyramid.
  - c. Perform meal planning, marketing, and meal preparation.
  - d. Describe the types of therapeutic diets.
  - e. Demonstrate how to assist/feed a client.
  - f. Document appropriate observations of nutrition and hydration intake/output.
12. Discuss homemaker services.
  - a. Describe the role of the homemaker in planning and providing care services.
  - b. Describe household management including budgeting and shopping.
  - c. Maintain a clean environment in the home.
  - d. Perform laundry duties.

## TECHNOLOGY EDUCATION

### Program Description Technology Applications

Technology Applications is a program in “pre-engineering” for high school students. Successful completion of Algebra I and an overall C average is a prerequisite for enrollment in this program. The purpose of the program is to provide students with expanded knowledge of the use of technological skills and to enable them to solve problems by applying knowledge in a technological context. The program is designed to provide students with “hands-on” experiences related to the application of technology education and engineering concepts in the workplace. Students will develop academic and technical skills, 21<sup>st</sup> Century skills, and human relations competencies which accompany technical skills for job success and life-long learning. Students who complete the program will be better prepared to enter and succeed in engineering programs offered by Mississippi community and junior colleges and institutions of higher education.

Industry standards referenced are from the *International Technology Education Association STL Content Standards*.

### COURSE GOALS

1. Develop Science, Technology, Engineering, and Mathematical (STEM) skills.
2. Improve recruitment among students into science, technology, engineering and mathematics fields.
3. Utilize technological systems to solve problems related to predictable and unpredictable, real-world situations.
4. Establish a comprehensive course that includes academic competencies, career and technical topics, the International Technology Education Association (ITEA) standards, and 21<sup>st</sup> Century Skills.
5. Implement a state of the art, secondary pre-engineering program.

## Course Outline

### Technology Applications I

Course CIP Code: 48.0202

**Course Description:** Technology Applications I is a course designed to introduce students to Science, Technology, Engineering, and Mathematical concepts. Problems will be solved using 21<sup>st</sup> Century, technology, academic, and investigative skills. Applications of science, technology engineering, and mathematics will be demonstrated in technical communication technology, computer aided design and drafting technology, manufacturing (CAD/CAM) technology, fluid systems technology, thermal systems technology, electrical systems technology, and mechanical systems technology. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Orientation and Safety	5
2	Preparing for a 21 <sup>st</sup> Century Workforce	15
3	Introduction to Science, Technology, Engineering, and Mathematics	15
4	The Design Process	10
5	Technical Communication	25
6	Computer Aided Design and Drafting (CADD)	25
7	Manufacturing (CAD/CAM) Technology	25
8	Fluid Systems Technology	25
9	Thermal Systems Technology	25
10	Electrical Systems Technology	25
11	Mechanical Systems Technology	25

**Technology Applications II**  
Course CIP Code: 48.0203

**Course Description:** Technology Applications II will permit second year students to expand and deepen their knowledge related to Science, Technology, Engineering, and Mathematics skills. Students will apply concepts related to computer assembly technology, computer networking technology, computer programming technology, geographic information systems technology, programmable logic control technology, electronic control systems technology, and computer integrated manufacturing technology. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Orientation & Safety Review	3
2	Computer Assembly Technology	25
3	Computer Networking Technology	25
4	Computer Programming Technology	25
5	Geographic Information Systems (GIS) Technology	25
6	Programming Logic Control	10
7	Electronic Control Systems Technology	25
8	Computer Integrated Manufacturing Technology	60
9	Directed Individual Project	22

**Course Name:** Technology Applications I

**Course CIP Code:** 48.0202

1. Identify course expectations, school policies, and program policies related to Technology Applications.
  - a. Give a brief overview of the course. Explain to students what Technology Applications is, why it is important, and how it will be delivered.
  - b. Preview the school handbook, the technology acceptable use policy, and all other safety procedures for the classroom and building level.
  - c. Preview course objectives, program policy, and the ITEA standards.
2. Demonstrate proper use and care for laboratory equipment related to the Technology Applications laboratory (ongoing).
  - a. Identify and describe the use of safety equipment and other safety precautions in the laboratory.
  - b. Describe operating procedures for the course including the roles and responsibilities of teachers and students in a modular instructional laboratory.
  - c. Introduce the modular workstations and the instructional resources provided in the Technology Applications laboratory.
  - d. Compare and contrast safety issues in the Technology Applications classroom to safety issues related to career fields in science, technology, and engineering.
3. Explore personality development and the classroom environment in relation to interpersonal skills, others, and the world of work.
  - a. Identify forces that shape personality development including personality traits, heredity, and environment.
  - b. Complete a learning style inventory.
  - c. Develop a report on how personality traits affect teamwork and leadership skills.
  - d. Write an autobiography.
4. Develop leadership skills.
  - a. Describe the qualities of an effective leader including positive attitude, image, decision making, communication skills, and knowledge.
  - b. Identify opportunities in the local community that develop leadership skills.
  - c. Dramatize effective leadership skills.
  - d. Practice effective leadership skills.
  - e. Prepare a project management methodology and use it consistently.
5. Exercise sound reasoning in understanding and making complex choices about working in teams.
  - a. Demonstrate an appreciation and respect for diversity.
  - b. Apply the components of good teamwork including team dynamics, status of team growth, and working through team problems.
  - c. Apply conflict resolution skills
6. Apply appropriate skills and techniques for resolving conflict among peers.
  - a. Learn technical terms related to conflict resolution.
  - b. Introduce problem solving procedures.
  - c. Practice resolving conflict.
7. Develop effective written, oral, and nonverbal communication skills.
  - a. Define effective written, oral, and nonverbal communication skills.
  - b. Identify the impact of effective communication.

- c. Analyze personal strengths/weaknesses in communication.
  - d. Develop a plan to improve written, oral, and nonverbal communication.
8. Utilize effective time management techniques.
  - a. Understand the purpose and process of developing a semester, weekly, and daily calendar.
  - b. Set semester, weekly, and daily priorities.
  - c. Create semester, weekly, and daily calendars.
9. Use the scientific method to identify the components, characteristics, and scope of mathematics, science, technology, and engineering.
  - a. Utilize the components, characteristics, and scope of science and technology (make the science and technology relevant to students).
  - b. Observe a problem related to mathematics, science, technology, and engineering.
  - c. Gather data and information about the problem.
  - d. Form a hypothesis based upon the information and data.
  - e. Design an experiment to test the hypothesis.
  - f. Collect data from the experimentation.
  - g. Analyze the data.
  - h. Form conclusions or inferences based upon the data.
  - i. Communicate the results via publications and presentations.
10. Apply science, technology, engineering, and mathematical concepts to solve real-world problems related to science, technology, and engineering.
  - a. Analyze general problem solving strategies.
  - b. Develop critical thinking skills in solving problems.
  - c. Utilize various aspects of “best” engineering solutions.
  - d. Analyze moving objects and explain their motion in relation to Newton’s Laws of Physics.
  - e. Apply Newton’s Laws of Physics as they relate to problem solving strategies.
11. Create a statistical analysis of different engineering fields, work experiences, and responsibilities.
  - a. Compare and contrast the modern world of engineering and the ancient world of engineering.
  - b. Research different engineering fields, job opportunities, salaries, licensure, degree requirements, and college programs of studies.
  - c. Research safety issues related to the field of engineering.
  - d. Present the statistical analysis.
12. Utilize proper measurement tools and attributes of objects, units, systems, and processes related to science, technology, engineering, and mathematics.
  - a. Identify examples of measurable attributes for objects, units, systems, and processes.
  - b. Summarize measurable attributes of objectives and the units, systems, and processes or measurement.
  - c. Apply appropriate techniques, tools, and formulas to determine measurement.
  - d. Calculate mass of objects.
  - e. Convert units of the English system of measurement to the Standard International units.
  - f. Convert units extensively (i.e., meters/sec. to min./hr. to cubic inches/day to liters/min.).

- g. Use technology to predict changes in measurement over time related to science, technology, mathematics, and engineering.
  - h. Convert units of measurement from one system to another.
  - i. Solve linear sets of equations for unknowns.
  - j. Use measurement systems to solve problems.
13. Utilize relevant chemical, mechanical, biological, electrical, and physical properties of material used in engineering projects.
- a. Define and identify examples of force, work, rate, resistance, energy, and power in mechanical, fluid, electrical, and thermal systems.
  - b. Summarize the role of force, work, rate, resistance, energy, and power in mechanical, fluid, electrical, and thermal systems.
  - c. Apply appropriate measurement techniques related to force, work, rate, resistance, energy, and power.
14. Explain the components of the design process.
- a. Define the design process.
  - b. Identify items that have been designed by engineers and items that have not been designed by engineers.
  - c. Apply concepts of planning, design, building, testing, quality assurance, and customer needs.
  - d. Conduct research, development, experimentation, and application.
  - e. Practice invention and innovation.
  - f. Summarize the design process.
15. Apply the components of the design process.
- a. Identify components of the design process.
16. Create a product using the design process.
- a. Identify a problem or design objective.
  - b. Define the goals and identify the constraints.
  - c. Research and gather information.
  - d. Create potential design solutions.
  - e. Analyze the viability of solutions.
  - f. Choose the most appropriate solution.
  - g. Build or implement the design.
  - h. Test and evaluate the design.
17. Describe basic concepts and proper use of the Internet.
- a. Give a brief overview of the history of the Internet.
  - b. Review the key parts of the Internet Browser application software
  - c. Explain the importance of the Internet, what it is used for, and how it will be used in the Technology Applications classroom.
  - d. Identify the various parts of a URL.
  - e. Research top-level domain names, how their status is determined, and which are more useful for particular situations.
  - f. Implement rules and proper online behavior.
  - g. Understand the consequences of not using the Internet properly.
18. Describe basic concepts of appropriate Internet communications.
- a. List and discuss netiquette as it applies to Internet communication.
  - b. Generate asynchronous communication such as e-mail, blogs, discussion boards, wikis, etc.

- c. Generate synchronous communication sessions such as chat rooms and interactive whiteboards.
19. Evaluate research from the Internet.
  - a. Distinguish between personal Web pages, commercial Web pages, and information pages, and research pages.
  - b. Compare search engines, mega search engines and meta search engines.
  - c. Use Boolean search techniques to perform an advanced search.
  - d. Discuss plagiarism and other copyright issues related to research, writing, and electronic sources.
  - e. Cite Internet resources using the APA or MLA format.
20. Create a Web page using technology productivity tools and concepts of practical Web design.
  - a. Differentiate between designing in HTML and a WYSIWYG environment.
  - b. Incorporate the essential HTML tags to complete a basic personal Web page.
  - c. Develop a basic Web page using text formatting tags, image tags, hyperlink tags and their necessary tag attributes.
  - d. Design a Web page related to a topic of interest.
  - e. Create a Web page related to a topic of interest.
  - f. Evaluate a created Web page related to a topic of interest.
21. Create effective technical writing documents.
  - a. Define technical writing as “writing that explains technology to various technical, organizational and societal audiences.”
  - b. Explore technical writing skills and use these skills to produce effective technical documents.
22. Explain basic concepts of computer aided drafting and design technology.
  - a. Trace the history of drafting and design.
  - b. Identify applications in business and industry.
  - c. Identify terms and concepts of drafting and design.
  - d. Demonstrate the proper use of scales, including engineers, architects, and metric scale.
  - e. Distinguish between the types of drawing views.
23. Demonstrate applications of computer aided drafting and design 2D.
  - a. Identify major commands of computer aided drafting and design 2D software.
  - b. Identify and design an engineering type drawing.
  - c. Identify and design an architectural type drawing.
24. Demonstrate applications of computer aided design 3D.
  - a. Identify major commands of 3D drawing software.
  - b. Identify and design a 3D engineering drawing.
  - c. Identify and construct a 3D engineering assembly drawing.
  - d. Demonstrate the animation of a 3D engineering drawing.
  - e. Identify and design a 3D architectural type drawing.
25. Describe basic concepts of CAD/CAM technology.
  - a. Identify applications of CAD/CAM technology.
  - b. Identify terms related to CAD/CAM technology.
  - c. Explain the XYZ coordinating relationships.
26. Perform applications of CAD/CAM technology.
  - a. Identify major commands of CAD/CAM software.

- b. Create a 2D and 3D wireframe drawing.
  - c. Create a 3D wireframe drawing complete with toolpaths and generated NC code.
  - d. Design a part that will be produced on a milling machine.
27. Determine how force affects fluid systems.
- a. Differentiate between hydraulic and pneumatic systems.
  - b. Define buoyant force.
  - c. Define pressure, both in words and in equation form.
  - d. Explain where atmospheric pressure comes from. State the sea level standard value for atmospheric pressure in the appropriate system of measure.
  - e. Describe the difference between absolute and gage pressure.
  - f. Explain how pressure in a fluid depends on depth of fluid.
  - g. Given a fluid system with two connected reservoirs, describe fluid levels in each reservoir that will cause fluid motion between reservoirs, or that will cause no action.
  - h. Explain how manometers are used to measure pressures.
28. Determine how work affects a fluid system.
- a. Describe how open and closed fluid systems are different.
  - b. Explain the relationship between work and pressure in a fluid system by the equations:  
Work = constant pressure x fluid volume moved  
 $W = p \times (\Delta V)$   
and  
Work = pressure difference x volume moved  
 $W = (\Delta p) \times V$
29. Determine how rate affects fluid systems.
- a. Describe a volume flow rate ( $Q_v$ ) as volume of fluid ( $V$ ) moved per unit time ( $t$ ), or  $Q_v = v/t$ .
  - b. Describe a mass-flow rate ( $Q_m$ ) as mass of fluid ( $m$ ) moved per unit time ( $t$ ), or  $Q_m = m/t$ .
  - c. Explain the meaning of the fluid rate equations.
  - d. Use rate equations to find an unknown.
30. Determine how resistance affects fluid systems.
- a. Describe resistance in fluid systems.
  - b. Distinguish between streamlined and turbulent flows.
  - c. Identify sources of resistance for a fluid moving through a pipe.
  - d. Identify the effects of resistance in a fluid flowing through a pipe.
  - e. Explain how fluid resistance in a pipe depends on pipe area, pipe length and type of fluid.
  - f. Describe how to reduce fluid resistance in a system.
31. Determine how energy affects fluid systems.
- a. Describe the characteristics of fluids.
  - b. Describe and illustrate how energy is used in fluid systems.
  - c. Differentiate between hydraulic and pneumatic systems.
  - d. Illustrate how to find the kinetic energy of fluids. Calculate fluid energy using the following formula:  
 $E_k = \frac{1}{2} (w/g) v^2$   
 $E_k = \text{kinetic energy in foot pounds}$

w = weight of fluid in pounds  
g = acceleration due to gravity  
(32 ft/sec<sup>2</sup>)

- e. Illustrate how to determine the potential energy stored in a fluid by using a formula.
32. Determine how power affects fluid
    - a. Define power in a fluid system as work divided by time:  
$$P = \frac{(\Delta p)v}{t}, \text{ or } P = \frac{p(\Delta v)}{t}$$
    - b. Explain why power in a fluid system obeys the unifying principle of work divided by time, or “force” times a rate.
    - c. Define the units of fluid power.
    - d. Use the equation for power in a fluid system to solve for an unknown.
    - e. Examine workplace applications where technicians measure or control power in fluid systems.
  33. Analyze work done in a thermal system.
    - a. Identify the direction of movement of heat energy in a thermal system when temperature information is known.
    - b. Describe the “forcelike” quantity in a thermal system.
    - c. Define temperature.
    - d. Describe the relationship between heat energy and molecular motion.
    - e. Given Celsius or Fahrenheit temperatures and the formula for the conversion, find the equivalent temperature on the alternate scale.
  34. Determine how rate affects fluid systems.
    - a. Describe heat-flow rate ( $Q_H$ ) as heat energy (H) moved per unit time (t), or  $Q_H = H/t$ .
    - b. Define rate units for thermal systems, using both English and SI measure.
    - c. Define heat capacity and specific heat.
    - d. Explain the meaning of the equation for thermal system rate.
    - e. Use this equation to find an unknown value.
    - f. Explain the difference between sensible and latent heat.
  35. Determine how resistance affects thermal systems.
    - a. Describe resistance in thermal systems.
    - b. Identify the effects of resistance in a thermal system.
    - c. Define thermal conductivity.
    - d. Explain the relationship between resistance, temperature difference, and heat-flow rate.
    - e. Show that thermal resistance obeys the unifying principle of a “force” divided by rate.
    - f. Explain the meaning of the R-factor as a measure of relative thermal resistance of insulation.
    - g. Identify what can be done to reduce or increase thermal resistance.
  36. Determine how energy affects thermal systems.
    - a. Describe the relationship between thermal energy and work.
    - b. Define the mechanical equivalent of heat.
    - c. Use the equation,  $H = mc\Delta T$ , to find how much heat energy is transferred between two objects at different temperatures.

- d. Describe three ways to transfer heat energy.
  - e. Describe how heat energy changes states—from solids to liquids to gases, and back again.
  - f. Describe the role of heat energy in the Law of Conservation of Energy.
  - g. Measure the transfer of heat energy.
  - h. Identify work place applications where technicians measure or control energy in thermal systems.
37. Determine how power affects thermal systems.
- a. Define power in a thermal system as work (energy) divided by time.
  - b. Relate power in a thermal system to rate.
  - c. Identify the units of thermal power.
  - d. Use the equation for power in a thermal system to solve for an unknown.
38. Determine how force affects electrical systems.
- a. Define and illustrate basic electrical energy terms.
  - b. Differentiate between AC and DC current.
  - c. Demonstrate the sequence for connecting a DC circuit in series.
  - d. Demonstrate how different voltages add up in a circuit.
  - e. Read schematic drawings of simple circuits.
  - f. Identify source, load, and conductor of a circuit and their symbols.
  - g. Explain how frequency and hertz relate to AC current.
  - h. Briefly describe how voltage acts as a force in an electrical system.
  - i. Explore the uses of a multimeter as a measuring tool.
  - j. Explore careers related to electrical systems.
39. Identify the effects of work done in electrical systems.
- a. Determine how work done by voltage affects an electrical system.
  - b. Solve electrical work problems, given voltage and electrical charge information.  
Work = Voltage x Electrical Charge Moved  
$$W = V \times q$$
  - c. Explain the relationship between work and voltage in an electrical system, as given by the following equation:  
Current = charge/time  
$$I = q/t$$
40. Determine how rate affects electrical systems.
- a. Explain the meaning of rate in electrical systems.
  - b. Use rate equations to find an unknown.
  - c. Describe charge-flow rate (I) as quantity of charge moved (q) per unit time (t), or  
$$I = q/t.$$
  - d. Distinguish between frequency and period.
41. Determine how resistance affects electrical systems.
- a. Describe resistance and resistivity in electrical systems.
  - b. Illustrate that the unifying principle of resistance is force divided by rate.
  - c. Use a graph to explain the relationship between resistance, voltage and current (Ohm's Law).
  - d. Show how resistance in a wire depends on the length of the wire, the cross-sectional area of wire, and the material the wire is made of.
  - e. Distinguish between conductors, semiconductors, and insulators.
  - f. Use the equation  $RE = (\Delta V)/I$  to solve for an unknown.

- g. Find total resistance of two or more resistors in parallel hookups and in series hookups.
  - h. Measure resistance in electrical systems.
42. Determine how energy affects electrical systems.
- a. Describe and illustrate how potential energy is stored in electrical systems.
  - b. Differentiate between batteries, capacitors, and inductors.
  - c. Demonstrate how capacitors oppose changes in voltage.
  - d. Determine the electrical energy stored in a capacitor and use the formula to calculate electrical potential energy stored in fixed and variable capacitors.
  - e. Demonstrate how inductors oppose changes in current in a circuit.
  - f. Determine the electrical energy stored in an inductor by using a formula.
43. Determine how power affects electrical systems.
- a. Define power in an electrical system as work divided by time
$$P = \frac{V \times q}{t}$$
  - b. Explain why power in an electrical system can also be described as voltage multiplied by a current, i.e. a force multiplied by a rate:
$$P = V \times I$$
  - c. Define the units of electrical power.
  - d. Use the equation for power in an electrical system to solve for an unknown.
  - e. Examine workplace applications where power is measured or controlled in electrical systems.
44. Calculate energy usage in kilowatt hours.
- a. Solve electrical energy problems for capacitance, given voltage, capacitance information in farads, and stored energy in joules.
  - b. Solve electrical energy problems for inductance, given voltage, inductance in henries, and current in amperes flowing through the inductors.
45. Determine how force affects mechanical systems.
- a. Define the concept of force in one or two sentences.
  - b. Identify a common device that's used to measure force.
  - c. Name the units of force used in the English measuring system.
  - d. Describe what happens when forces on an object are balanced.
  - e. Describe what happens when forces on an object are unbalanced.
  - f. Briefly define the following: scalar, vector, weight, mass, and torque.
  - g. Describe torque's relationship to clockwise and counterclockwise movement.
  - h. Solve torque problems, given force and lever arm information.
46. Analyze work affects mechanical system.
- a. Identify the effects of work done by a force in a mechanical system.
  - b. Define/calculate work done by a force in a mechanical system using the formula:
$$W = F \times D$$
Work = force applied x distance object moves while force applied
  - c. Explain how efficiency relates to input work and output work for a mechanical system.
  - d. Calculate efficiency using the formula:
$$\text{Efficiency (\%)} = \frac{\text{output work}}{\text{input work}} \times 100$$

- e. Define radian measures of angles. Solve rotational work problems using torque.  
 $W = T \times \theta$   
 Work = torque applied x angle moved through
47. Determine how rate affects mechanical systems.
- Define speed, velocity, and acceleration.
  - Explain the difference between speed and velocity.
  - Explain the differences between velocity and acceleration.
  - Use speed, velocity, and acceleration to solve problems involving linear motion.
  - Compare and contrast angular speed and angular acceleration.
  - Solve equations/problems related to rate in mechanical systems.
48. Determine how resistance affects mechanical systems.
- Review Newton's laws of motion and solve problems involving force, mass, and acceleration.
  - Calculate the weight and mass of objects.
  - Compare and contrast static and kinetic friction.
  - Calculate the force of friction between two surfaces.
49. Determine how energy affects mechanical systems.
- Describe and illustrate how potential and kinetic energy are used in mechanical systems.
  - Differentiate between gravitational potential energy and elastic potential energy.
  - Illustrate how gravitational potential energy equals the work done to lift an object to a higher position and use the formula to calculate gravitational potential energy:  $E_p = w \times h$ .
  - Illustrate how elastic potential energy equals the work done to stretch or compress elastic objects and use the formula to calculate elastic potential energy :  $E_p = \frac{1}{2} \times kd^2$ .
  - Differentiate between linear kinetic energy and rotational kinetic energy.
  - Illustrate how kinetic energy involves mass and linear motion and use the formula  $E_k = \frac{1}{2} mv^2$ .
  - Illustrate how kinetic energy involves the moment of inertia and rotational motion and use the formula  $E_k = \frac{1}{2} I \omega^2$ .
  - Describe conversion between types of energy in mechanical systems
50. Determine how power affects mechanical systems.
- Define power in a linear mechanical system as work divided by time:  
 $P = \frac{W}{t}$ , or  $P = \frac{F \times D}{t}$
  - Explain why power in a linear mechanical system also can be described as force times a rate:  
 $P = F \times \frac{D}{t}$ , or  $P = F \times v$
  - Define power in a rotational mechanical system as work divided time:  
 $P = \frac{W}{t}$ , or  $P = \frac{T \times \theta}{t}$ .

- d. Explain why power in a rotational mechanical system also can be described as a force times a rate:

$$P = T \times \frac{\theta}{t}, \text{ or } P = T \times \omega$$

- e. Identify the units of fluid power.  
f. Define efficiency as output power divided by input power.  
g. Use equations for power in a mechanical system to solve for an unknown.

**Course Name:** Technology Applications II  
**Course CIP Code:** 48.0203

1. Describe general policies and procedures for participating in the Technology Applications II course.
  - a. Identify policies and procedures for instruction in the course.
  - b. Demonstrate understanding of safety rules.
  - c. Recognize classroom materials and resources that students will use in the course.
  - d. Describe and apply principles of teamwork as related to the course and to careers.
2. Investigate career and workplace skills.
  - a. Discuss employer expectations of employees.
  - b. Complete a personal interest profile.
  - c. Demonstrate basic communication/presentation skills.
  - d. Identify critical occupational safety skills.
3. Identify basic concepts of computer assembly technology.
  - a. Identify terms related to computer assembly technology.
  - b. Identify the major components of a typical PC.
  - c. Describe the power-on sequence of a typical PC.
  - d. Explain how major components interact with each other.
  - e. Identify common tools used to service a PC.
  - f. Explain how to install a printer.
4. Perform applications of computer assembly technology.
  - a. Identify each of the common types of Intel processors and demonstrate how to upgrade a system.
  - b. Assemble a computer.
  - c. Install print driver software.
  - d. Complete printer setup and installation.
  - e. Create a presentation demonstrating how to assemble a computer.
5. Solve problems related to computer assembly technology.
  - a. Investigate commonly practiced troubleshooting steps.
  - b. Recognize common startup problems and understand their causes.
  - c. Restart a PC in a variety of troubleshooting modules.
  - d. Step through a PC's boot sequence.
  - e. Explain how to access, repair, and back up files.
  - f. Explain basic data recovery methods.
  - g. Identify and diagnose common laser printer faults.
6. Identify applications of computer networking technology
  - a. Identify terms related to networking including but not limited to network, server, client, LAN, WAN, MAN, Network Interface Card (NIC), hub, switch, Cat5 Cable, fiber optic cable, and bandwidth.
  - b. Describe a typical network and advantages of using a network.
  - c. Identify different types of networks: client-server, peer-to-peer.
  - d. Identify the geography of networks: LAN and WAN.
  - e. Illustrate network topologies.
7. Perform applications of computer networking technology.
  - a. Design a simple LAN.
  - b. Set up network hardware.

- c. Install and configure server and client operating systems.
  - d. Solve problems related to networking.
8. Identify applications of computer programming technology.
  - a. Define terms associated with computer programming technology.
  - b. Construct an algorithm for computer programming technology.
  - c. Develop a basic understanding of the C++ programming language.
9. Perform applications of programming networking technology.
  - a. Research careers related programming technology.
  - b. Research and complete tutorials related to programming networking technology.
10. Solve problems related to computer programming.
  - a. Select a problem related to a career of interest that can be solved by using programming technology.
  - b. Produce a solution to the problem using programming technology.
11. Describe applications of geographic information systems technology.
  - a. Define terms associated with GIS systems.
  - b. Discuss how GIS relates to the environment.
12. Apply concepts of geographic information technology and environmental technology.
  - a. Research possible problems that GIS can be used to help solve.
13. Infer the results of accumulated data using geographical information systems technology.
  - a. Use GIS technology to solve problems.
14. Identify applications of programmable logic control (PLC) technology.
  - a. Trace the history of the development of programmable logic control technology, including programmable automation controllers.
  - b. Describe the purpose and applications of programmable logic control.
  - c. Define terms related to programmable logic control technology.
  - d. Explain ladder logic programming and how it differs from other types of programming.
  - e. Explain the difference between microprocessors and personal computers.
15. Create a statistical analysis of careers related to PLC.
  - a. Compare and contrast the modern world of PLC and the ancient world of PLC.
  - b. Research different careers, salaries, degree requirements, and possible college programs related to PLC.
  - c. Research safety issues related to PLC.
  - d. Present a statistical analysis.
16. Describe applications of electronic control systems technology.
  - a. Trace the nature and evolution of electronic control systems technology.
  - b. Identify terms related to electronic control systems technology.
  - c. Explore logic gate characteristics - examine the types of logic gates and identify the gates: AND, NAND, NOT, NOR, OR.
17. Apply concepts of electronic control systems technology.
  - a. Conduct a practical exercise to identify components of electronic control systems technology.
  - b. Construct truth tables associated with each of the gates: AND, NAND, NOT, NOR, OR.

- c. Engage in a practical exercise to construct and demonstrate projects that will utilize light sensors, proximity sensors, infrared sensors, touch sensors, speed controls, relays and solenoids.
18. Design a robotics program.
  - a. Identify safety measures for robotics and materials handling.
  - b. Identify robotic system components.
  - c. Identify the components of a robotic software program.
  - d. Design, program and execute a robotics application.
19. Construct a computer numerical control program (CNC).
  - a. Identify safety rules for operating a machining center.
  - b. Identify machining center hardware components.
  - c. Identify the components of a CNC software program.
  - d. Identify and create an NC (numerical control) part program.
  - e. Verify and run a numerical control program in a machining center.
  - f. Develop an NC part program from a part drawing.
20. Set up a computer integrated manufacturing cell (CIM) which will enable handshaking between a robot and a milling machine.
  - a. Identify the components of a CIM cell.
  - b. Develop a program for moving the robot to all positions in the CIM cell and synchronizes the robot's movements with mill's operations.
  - c. Develop an NC program to make a part, and have the mill synchronize with the robot.
21. Use science, technology, engineering, and mathematical principles and concepts to create solutions for real-world problems related to a career of interest.
  - a. Identify a problem related to a career of interest.
  - b. Gather research related to the problem.
  - c. Analyze potential solutions for the problem.
  - d. Develop and test models related to the solution.
  - e. Present the best solution related to the problem.
  - f. Perform post-implementation review and assessment of the solution.

## TRADE, INDUSTRIAL, AND RELATED TECHNOLOGY

### **Program Description Automotive Collision Repair Technology**

Automotive Collision Repair Technology I is an instructional program that orients an individual to the field of automotive collision repair. Automotive Collision Repair Technology II is a continuation of Automotive Collision Repair Technology I and allows an individual to prepare for employment or continued education in the occupation of automotive collision repair.

Each course must be taught in a minimum two class period block. The first course in the program includes instruction in the foundation skills related to safety, tools and equipment usage measurement, basic automotive collision repair, non-structural and structural analysis and damage repair, mechanical and electrical, and painting and refinishing. The second course in the program provides students with advanced skills related to non-structural and structural analysis and damage repair, mechanical and electrical, and painting and refinishing.

The program is aligned with the ASE/NATEF—2006 Collision Repair & Refinishing standards, which were retrieved May 1, 2006, from <http://www.natef.org>. Programs seeking certification may receive certification in Painting and Refinishing. Programs can seek certification in other areas if they so desire.

## Course Outline

### Automotive Collision Repair Technology I

Course CIP Code: 47.0603

**Course Description:** Automotive Collision Repair Technology I is an instructional program that orients an individual to the field of automotive collision repair. This course allows an individual to prepare for employment or continued education in the occupation of automotive collision repair. Topics include Introduction and Safety, Basic Tools Usage, Basic Non-Structural and Structural Analysis and Repair, Basic Mechanical and Electrical Components, and Basic Painting and Refinishing. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Introduction and Orientation	2
2	Safety	8
3	Tools, Technical References, Measurements, and Fasteners	15
4	Basic Non-Structural Analysis and Damage Repair	30
5	Basic Structural Analysis and Damage Repair	20
6	Basic Mechanical and Electrical Components	20
7	Basic Painting and Refinishing	160

### Automotive Collision Repair Technology II

Course CIP Code: 47.9990

**Course Description:** Automotive Collision Repair Technology II is an instructional program that orients an individual to the field of automotive collision repair. This course allows an individual to prepare for employment or continued education in the occupation of automotive collision repair. Topics include Safety, Advanced Non-Structural and Structural Analysis and Repair, Advanced Mechanical and Electrical Components, and Advanced Painting and Refinishing. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Safety (Review)	5
2	Advanced Non-Structural Analysis and Damage Repair	30
3	Advanced Structural Analysis and Damage Repair	20
4	Advanced Mechanical and Electrical Components	20
5	Advanced Painting and Refinishing	180

**Course Name:** Automotive Collision Repair Technology I

**Course CIP Code:** 47.0603

1. Introduce concepts and terms associated with the collision repair industry.
2. Describe local program and vocational/career technical center policies and procedures.
  - a. Describe local program and vocational/career technical center policies and procedures including dress code, attendance, academic requirements, discipline, and transportation regulations.
  - b. Compare and contrast local program policies, procedures, and expectations to industry policies, procedures, and expectations.
  - c. Preview the school technology acceptable use policy.
3. Explore employment opportunities and responsibilities.
  - a. Describe employment opportunities including potential earnings, employee benefits, job availability, place of employment, working conditions, and educational requirements.
  - b. Describe basic employee responsibilities.
4. Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA.
  - a. Demonstrate effective teambuilding and leadership skills.
  - b. Practice appropriate work ethics.
5. Demonstrate the ability to follow verbal and written instructions and communicate effectively in on- the-job situations.
6. Discuss the history of the collision repair industry to include materials, terminology, and techniques.
7. Describe general safety rules for working in a shop/lab and industry.
  - a. Describe how to avoid on-site accidents.
  - b. Explain the relationship between housekeeping and safety.
  - c. Explain the importance of following all safety rules and company safety policies.
  - d. Explain the importance of reporting all on-the-job injuries and accidents.
  - e. Explain the need for evacuation policies and the importance of following them.
  - f. Explain the employer's substances abuse policy and how it relates to safety.
  - g. Explain the safety procedures when working near pressurized or high temperature.
8. Identify and apply safety around collision operations.
  - a. Use proper safety practices when performing collision operations.
  - b. Recognize and explain personal protective equipment.
  - c. Inspect and care for personal protective equipment.
9. Explain lifting.
  - a. Identify and explain the procedures for lifting heavy objects.
10. Explain the Material Safety Data Sheet (MSDS).
  - a. Explain the function of the MSDS.
  - b. Interpret the requirements of the MSDS.
11. Explain fires.
  - a. Explain the process by which fires start.
  - b. Explain fire prevention of various flammable liquids.
  - c. Explain the classes of fire and the types of extinguishers.

12. Explain safety in and around collision repair and electrical situations.
  - a. Explain injuries when electrical contact occurs.
  - b. Explain safety around collision repair and electrical hazards.
  - c. Explain action to take when an electrical shock occurs.
13. Demonstrate safe and proper use and storage of tools and equipment in an automotive collision repair lab.
  - a. Identify and demonstrate the safe and proper use of common hand tools including wrenches, screwdrivers, pliers, hammers, chisels, body hammers, slide hammers, pull rods, suction cups, and dollies.
  - b. Identify and demonstrate the safe use of hand-operated power tools including paint sprayer, pneumatic grinders, sanders, drills, dent removal system, and files.
  - c. Identify hand tools used for body filling and shaping including surform (cheese grater), bondo spreader (squeegee), and sanding blocks.
  - d. Identify hand tools used for special body work including pop rivet gun, door handle removal tools, windshield knife, and interior and exterior trim removal tools.
  - e. Identify and describe the safe use of portable and stationary power equipment including hydraulic body jacks, spray booth, frame alignment and straightening equipment, floor jacks, hoists, hydraulic automobile lifts, and drill press.
  - f. Identify and demonstrate the safe and proper use of lifting equipment.
  - g. Identify and demonstrate the safe and proper use of cleaning equipment.
  - h. Organize and maintain a systematic storage system for hand and power tools.
14. 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).
15. Demonstrate measurement practices used in the automotive service.
  - a. Measure the length of an object using a rule to the nearest 1/16th of an inch and 1 millimeter.
16. 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.
17. Explain the computerized systems used for estimating collision repairs, measuring damage, and mixing or matching paint.
18. Explore preparation of body components.
  - a. Review damage report and analyze damage to determine appropriate methods for overall repair; develop and document a repair plan.
  - b. Inspect, remove, store, and replace exterior trim and moldings.
  - c. Inspect, remove, store, and replace interior trim and components.
  - d. Inspect, remove, store, and replace non-structural body panels and components that may interfere with or be damaged during repair.

- e. Inspect, remove, store, and replace all vehicle mechanical and electrical components that may interfere with or be damaged during repair.
  - f. Protect panels, glass, and parts adjacent to the repair area.
  - g. Soap and water wash entire vehicle; use appropriate cleaner to remove contaminants from those areas to be repaired.
  - h. Apply safety procedures associated with vehicle components and systems according to manufacturers' specifications/procedures.
19. Explore outer body panels (repairs, replacement, and adjustments).
- a. Determine the extent of direct and indirect damage and direction of impact; develop and document a repair plan.
  - b. Inspect, remove and replace bolted, bonded, and welded steel panel or panel assemblies.
  - c. Inspect, remove, replace, and align hood, hood hinges, and hood latch.
  - d. Inspect, remove, replace, and align deck lid, lid hinges, and lid latch.
  - e. Inspect, remove, replace, and align doors, tailgates, hatches, lift gates, latches, hinges, and related hardware.
  - f. Inspect, remove, replace, and align bumper bars, covers, reinforcement, guards, isolators, and mounting hardware.
  - g. Inspect, remove, replace, and align front fenders, headers, and other panels.
  - h. Straighten and rough-out contours of damaged panels to a suitable condition for body filling or metal finishing using power tools, hand tools, and weld-on pull attachments.
  - i. Weld damaged or torn steel body panels; repair broken welds.
20. Explore metal finishing and body filling.
- a. Remove paint from the damaged area of a body panel.
  - b. Locate and reduce surface irregularities on a damaged body panel.
  - c. Demonstrate hammer and dolly techniques.
  - d. Heat shrink stretched panel areas to proper contour according to manufacturer's specifications.
  - e. Cold shrink stretched panel areas to proper contour.
  - f. Mix body filler.
  - g. Apply body filler; shape during curing.
  - h. Rough sand cured body filler to contour; finish sand.
21. Explore metal welding and cutting procedures for non-structural applications.
- a. Identify weldable and non-weldable materials used in collision repair.
  - b. Weld and cut high-strength steel and other steels using manufacturer's specifications/procedures.
  - c. Determine the correct welder type, electrode, wire type, diameter, and gas to be used in a specific welding situation.
  - d. Set up and adjust the GMAW (MIG) welder to "tune" for proper electrode stickout, voltage, polarity, flow rate, and wire-feed speed required for the material being welded.
  - e. Store, handle, and install high-pressure gas cylinders.
  - f. Determine work clamp (ground) location and attach.
  - g. Use the proper angle of the gun to the joint and direction of gun travel for the type of weld being made in the flat, horizontal, vertical, and overhead positions.

- h. Protect adjacent panels, glass, vehicle interior, etc. from welding and cutting operations.
  - i. Protect computers and other electronic control modules during welding procedures according to manufacturer's specifications.
  - j. Clean and prepare the metal to be welded, assure good metal fit-up, apply weld-through primer if necessary, and clamp as required.
  - k. Determine the joint type (butt weld with backing, lap, etc.) for weld being made according to manufacturer's/industry specifications.
  - l. Determine the type of weld (continuous, butt weld with backing, plug, etc.) for each specific welding operation according to manufacturer's/industry specifications.
22. Explore frame inspection and repair.
- a. Diagnose and measure structural damage using tram and self-centering gauges according to industry specifications.
  - b. Attach vehicle to anchoring devices.
  - c. Analyze and identify misaligned or damaged steering, suspension, and power train components that can cause vibration, steering, and wheel alignment problems; align or replace in accordance with vehicle manufacturer's specifications/procedures.
  - d. Diagnose and measure structural damage using a universal measuring system (mechanical, electrical, laser).
  - e. Diagnose and measure structural vehicles using a dedicated (fixture) measuring system.
  - f. Determine the extent of the direct and indirect damage and the direction of impact; document the methods and sequence of repair.
23. Explore unibody inspection, measurement, and repair.
- a. Identify misaligned or damaged steering, suspension, and power train components that can cause vibration, steering, and chassis alignment problems; realign or replace in accordance with vehicle manufacturer's specifications/procedures.
  - b. Diagnose and measure unibody damage using tram and self-centering gauges according to industry specifications.
  - c. Attach anchoring devices to vehicle; remove or reposition components as necessary.
  - d. Identify heat limitations in unibody vehicles in accordance with vehicle manufacturer's specifications/procedures
  - e. Identify proper cold stress relief methods.
  - f. Repair damage using power tools and hand tools to restore proper contours and dimensions.
24. Explore procedures for fixed glass removal and installation.
- a. Remove and reinstall or replace fixed glass (heated and non-heated) using manufacturer's specifications/procedures and recommended materials.
25. Explore metal welding and cutting for non-structural applications.
- a. Identify weldable and non-weldable materials used in collision repair.
  - b. Weld and cut high-strength steel and other steels using manufacturer's specifications/procedures.
  - c. Determine the correct welder type, electrode, wire type, diameter, and gas to be used in a specific welding situation.

- d. Set up and adjust the GMAW (MIG) welder to "tune" for proper electrode stickout, voltage, polarity, flow rate, and wire-feed speed required for the material being welded.
  - e. Store, handle, and install high-pressure gas cylinders.
  - f. Determine work clamp (ground) location and attach.
  - g. Use the proper angle of the gun to the joint and direction of gun travel for the type of weld being made in the flat, horizontal, vertical, and overhead positions.
  - h. Protect adjacent panels, glass, vehicle interior, etc. from welding and cutting operations.
  - i. Protect computers and other electronic control modules during welding procedures according to manufacturer's specifications.
  - j. Clean and prepare the metal to be welded, assure good metal fit-up, apply weld-through primer if necessary, and clamp as required.
  - k. Determine the joint type (butt weld with backing, lap, etc.) for weld being made according to manufacturer's/industry specifications.
  - l. Determine the type of weld (continuous, butt weld with backing, plug, etc.) for each specific welding operation according to manufacturer's/industry specifications.
26. Explore suspension and steering components and systems.
- a. Identify suspension system fasteners that should not be reused.
  - b. Inspect and adjust (where applicable) steering linkage geometry (attitude/parallelism).
  - c. Inspect and replace pitman arm.
  - d. Inspect and replace relay (center link/intermediate) rod.
  - e. Inspect, remove, and replace idler arm and mountings.
  - f. Inspect, remove, and replace tie rod sleeves, clamps, and tie rod ends.
  - g. Inspect, remove, and replace steering linkage damper.
  - h. Inspect, remove, and replace shock absorbers.
  - i. Measure vehicle ride height; determine needed repairs.
  - j. Diagnose tire wear patterns; determine needed repairs.
  - k. Inspect tires; identify direction of rotation, and location; check and adjust air pressure.
  - l. Diagnose wheel/tire vibration, shimmy, and tramp (wheel hop) problems; determine needed repairs.
  - m. Reinstall wheels and torque lug nuts according to manufacturer's specifications.
27. Explore electrical/electronic systems.
- a. Inspect, test, and replace fusible links, circuit breakers, and fuses.
  - b. Perform battery state-of-charge test; determine needed service.
  - c. Inspect, clean, and replace battery.
  - d. Dispose of batteries and battery acid according to local, state, and federal requirements.
  - e. Perform slow/fast battery charge in accordance with manufacturer's recommendations.
  - g. Inspect, clean, and repair or replace battery cables, connectors, and clamps.
  - h. Inspect alignment, adjust, and replace generator (alternator) drive belts, pulleys, and fans.
  - i. Remove and replace generator (alternator).

- j. Check operation of exterior lighting; determine needed repairs.
  - k. Remove and replace horn(s); check operation.
  - l. Check operation of windshield wiper/washer system.
  - m. Check operation of power side windows and power tailgate window.
  - n. Inspect, remove, and replace power seat, motors, linkages, cables, etc.
  - o. Inspect, remove, and replace components of electric door and hatch/trunk lock.
  - p. Inspect, remove, and replace components of keyless lock/unlock devices and alarm systems.
  - q. Inspect, remove, and replace components of power antenna circuits.
  - r. Demonstrate the proper self-grounding procedures for handling electrical components.
28. Explore brakes and braking systems.
- a. Inspect brake lines and fittings for leaks, dents, kinks, rust, cracks, or wear; tighten loose fittings and supports; replace brake lines (double flare and ISO types), hoses, fittings, and supports.
  - b. Inspect flexible brake hoses for leaks, kinks, cracks, bulging or wear; remove and replace hoses; tighten loose fittings and supports.
  - c. Identify, handle, store, and install appropriate brake fluids; dispose of in accordance with federal, state, and local regulations.
  - d. Bleed (manual, pressure, vacuum, or surge) hydraulic brake system in accordance with manufacturer's procedures.
  - e. Adjust brake shoes; remove and reinstall brake drums or drum/hub assemblies and wheel bearings.
  - f. Reinstall wheel and torque lug nuts according to manufacturer's specifications.
  - g. Check for bent or damaged brake system components.
29. Explore heating and air conditioning.
- a. Identify and comply with environmental concerns relating to refrigerants and coolants.
  - b. Locate and identify A/C system service ports.
  - c. Identify, label, and store refrigerant.
  - d. Evacuate A/C system; check for leaks.
  - e. Recharge A/C system with refrigerant; perform leak test.
  - f. Identify oil type and maintain correct amount in A/C system according to manufacturer's specifications.
30. Explore cooling systems.
- a. Inspect and replace engine cooling and heater system hoses and belts.
  - b. Inspect, test, remove, and replace radiator, pressure cap, coolant recovery system, and water pump.
  - c. Recover, refill, and bleed system with proper coolant and check level of protection; leak test system and dispose of materials in accordance with EPA specifications.
  - d. Remove and replace fan (both electrical and mechanical), fan pulley, fan clutch, and fan shroud.
31. Explore and apply safety precautions for painting and refinishing operations.
- a. Identify and take necessary precautions with hazardous operations and materials according to federal, state, and local regulations.

- b. Identify safety and personal health hazards according to OSHA guidelines and the “Right to Know Law.”
  - c. Inspect spray environment to ensure compliance with federal, state, and local regulations and for safety and cleanliness hazards.
  - d. Select and use the NIOSH approved personal sanding respirator. Inspect condition and ensure fit and operation. Perform proper maintenance in accordance with OSHA Regulation 1910.134 and applicable state and local regulations.
  - e. Select and use the NIOSH approved (Fresh Air Make-up System) personal painting/refinishing respirator system. Perform proper maintenance in accordance with OSHA Regulation 1910.134 and applicable state and local regulation.
  - f. Select and use the proper personal safety equipment for surface preparation, spray gun and related equipment operation, paint mixing, matching and application, paint defects, and detailing (gloves, suits, hoods, eye and ear protection, etc.).
32. Explore surface preparation.
- a. Inspect, remove, store, and replace exterior trim and components necessary for proper surface preparation.
  - b. Soap and water wash entire vehicle; use appropriate cleaner to remove contaminants.
  - c. Inspect and identify substrate, type of finish and surface condition; develop and document a plan for refinishing using a total product system.
  - d. Remove paint finish in accordance with manufacturer’s recommendations.
  - e. Dry or wet sand areas to be refinished.
  - f. Featheredge damaged areas to be refinished.
  - g. Apply suitable metal treatment or primer in accordance with total product systems.
  - h. Mask and protect other areas that will not be refinished.
  - i. Mix primer, primer-surfacer, or primer-sealer.
  - j. Apply primer onto surface of repaired area.
  - k. Apply two-component finishing filler to minor surface imperfections.
  - l. Dry or wet sand area to which primer-surfacer has been applied.
  - m. Dry sand area to which two-component finishing filler has been applied.
  - n. Remove dust from area to be refinished, including cracks or moldings of adjacent areas.
  - o. Clean area to be refinished using a final cleaning solution.
  - p. Remove, with a tack rag, any dust or lint particles from the area to be refinished.
  - q. Apply suitable sealer to the area being refinished when sealing is needed or desirable.
  - r. Scuff sand to remove nibs or imperfections from a sealer.
  - s. Restore corrosion-resistant coatings, caulking, and seam sealers to repaired areas.
  - t. Prepare adjacent panels for blending.
  - u. Prepare plastic panels for refinishing.
33. Explore paint spray guns and related equipment.
- a. Inspect, clean, and determine condition of spray guns and related equipment (air hoses, regulators, air lines, air source, and spray environment).
  - b. Check and adjust spray gun operation for HVLP (high volume, low pressure) or LVLP (low volume, low pressure) guns.

- c. Set up (fluid needle, nozzle, and cap), adjust, and test spray gun using fluid, air, and pattern control valves.
34. Explore mixing, matching, and applying paint.
- a. Determine type and color of paint already on vehicle by manufacturer's vehicle information label.
  - b. Shake, stir, reduce, catalyze/activate, and strain paint according to manufacturer's procedures.
  - c. Apply finish using appropriate spray techniques (gun arc, gun angle, gun distance, gun speed, and spray pattern overlap) for the finish being applied.
  - d. Apply selected product on test and let-down panel in accordance with manufacturer's recommendations; check for color match.
35. Discuss and perform final detail operations to a vehicle.
- a. Clean interior, exterior, and glass.
  - b. Clean body openings (door jambs & edges, etc.).
  - c. Remove overspray.

**Course Name:** Automotive Collision Repair Technology II

**Course CIP Code:** 47.9990

1. Describe general safety rules for working in a shop/lab and industry.
  - a. Describe how to avoid on-site accidents.
  - b. Explain the relationship between housekeeping and safety.
  - c. Explain the importance of following all safety rules and company safety policies.
  - d. Explain the importance of reporting all on-the-job injuries and accidents.
  - e. Explain the need for evacuation policies and the importance of following them.
  - f. Explain the employer's substances abuse policy and how it relates to safety.
  - g. Explain the safety procedures when working near pressurized or high temperature.
2. Identify and apply safety around automotive operations.
  - a. Use proper safety practices when performing automotive operations.
  - b. Recognize and explain personal protective equipment.
  - c. Inspect and care for personal protective equipment.
3. Explain lifting.
  - a. Identify and explain the procedures for lifting heavy objects.
4. Explain the Material Safety Data Sheet (MSDS).
  - a. Explain the function of the MSDS.
  - b. Interpret
5. Explain fires.
  - a. Explain the process by which fires start.
  - b. Explain fire prevention of various flammable liquids.
  - c. Explain the classes of fire and the types of extinguishers.
6. Explain safety in and around automotive collision repair and electrical situations.
  - a. Explain injuries when electrical contact occurs.
  - b. Explain safety around automotive collision repair and electrical hazards.
  - c. Explain action to take when an electrical shock occurs.
7. Explore metal finishing and body filling.
  - a. Remove paint from the damaged area of a body panel.
  - b. Locate and reduce surface irregularities on a damaged body panel.
  - c. Demonstrate hammer and dolly techniques.
  - d. Heat shrink stretched panel areas to proper contour according to manufacturer's specifications.
  - e. Cold shrink stretched panel areas to proper contour.
  - f. Mix body filler.
  - g. Apply body filler; shape during curing.
  - h. Rough sand cured body filler to contour; finish sand.
8. Explore moveable glass and hardware.
  - a. Inspect, adjust, and repair/replace window regulators; run channels, glass, power mechanisms, and related controls.
  - b. Diagnose and repair water leaks, dust leaks, and wind noises; inspect, repair, and replace weather-stripping.
  - c. Inspect, repair or replace, and adjust removable, manually or power operated roof panel and hinges, latches, guides, handles, retainer, and controls of sunroofs.
9. Inspect, remove, reinstall, and align convertible top and related mechanisms.

10. Perform the following welds: continuous, stitch, tack, plug, butt weld with and without backing, and lap joints.
  - a. Perform visual and destructive tests on each weld type.
  - b. Identify the causes of various welding defects; make necessary adjustments.
  - c. Identify cause of contact tip burn-back and failure of wire to feed; make necessary adjustments.
  - d. Identify cutting process for different materials and locations in accordance with manufacturer's procedures; perform cutting operation.
11. Explore plastics and adhesives.
  - a. Identify the types of plastics; determine repairability.
  - b. Identify the types of plastics repair procedures; clean and prepare the surface of plastic parts.
  - c. Replace or repair rigid, semi-rigid, and flexible plastic panels according to manufacturer's/industry specifications.
  - d. Remove or repair damaged areas from rigid exterior sheet-molded compound (SMC) panels.
  - e. Replace bonded sheet-molded compound (SMC) body panels; straighten or align panel supports.
12. Explore frame inspection and repair.
  - a. Remove and replace damaged structural components according to manufacturer's specifications/procedures.
  - b. Restore corrosion protection to repaired or replaced frame areas.
13. Explore unibody inspection, measurement, and repair.
  - a. Determine and inspect the locations of all suspension, steering, and power train component attaching points on the vehicle.
  - b. Diagnose and measure unibody vehicles using a dedicated (fixture) measuring system.
  - c. Diagnose and measure unibody vehicles using a universal measuring system (mechanical, electronic, laser).
  - d. Determine the extent of the direct and indirect damage and the direction of impact; plan and document the methods and sequence of repair.
  - e. Remove and replace damaged sections of structural steel body panels in accordance with manufacturer's specifications/ procedures.
  - f. Restore corrosion protection to repaired or replaced unibody structural areas.
14. Explore fixed glass.
  - a. Remove and reinstall or replace modular glass using manufacturer's specifications/procedures and recommended materials.
15. Explore metal welding and cutting principles and practices.
  - a. Perform the following welds: continuous, stitch, tack, plug, butt weld with and without backing, and lap joints.
  - b. Perform visual and destructive tests on each weld type.
  - c. Identify the causes of various welding defects; make necessary adjustments.
  - d. Identify cause of contact tip burn-back and failure of wire to feed; make necessary adjustments.
  - e. Identify cutting process for different materials and locations in accordance with manufacturer's procedures; perform cutting operation.

- f. Identify different methods of attaching structural components (squeeze type resistance spot welding (STRSW), riveting, structural adhesive, silicone bronze, etc.)
16. Explore suspension and steering systems.
    - a. Inspect, remove, and replace upper and lower control arms.
    - b. Inspect, remove, and replace upper and lower control arm bushings, shafts and rebound bumpers.
    - c. Inspect, remove, and replace upper and lower ball joints.
    - d. Check for front wheel setback; determine needed repairs.
  17. Explore electrical/electronic systems.
    - a. Aim headlamp assemblies and fog/driving lamps; determine needed repairs.
    - b. Inspect, test, and repair or replace switches, relays, bulbs, sockets, connectors, and wires of all interior and exterior light circuits.
  18. Explore brakes and braking systems.
    - a. Remove and reinstall caliper assembly.
    - b. Clean and inspect caliper mountings for wear and damage.
    - c. Check parking brake system operation.
  19. Explore heating and air conditioning systems.
    - a. Maintain and verify correct operation of certified refrigerant recovery and recharging equipment.
    - b. Identify and recover refrigerant from A/C system.
    - c. Recycle refrigerant in accordance with EPA regulations.
    - d. Test recycled refrigerant for non-condensable gases
    - e. Inspect, adjust, and replace A/C compressor drive belts; check pulley alignment.
    - f. Remove and replace A/C compressor; inspect and repair/replace A/C compressor mount.
    - g. Inspect and repair/replace A/C system mufflers, hoses, lines, fittings, and seals.
    - h. Inspect, test, and replace A/C system condenser and mounts.
    - i. Inspect and replace receiver/drier or accumulator/drier.
    - j. Inspect and repair A/C component wiring.
  20. Explore cooling systems.
    - a. Inspect, remove, and replace auxiliary oil/fluid coolers; check oil levels.
    - b. Inspect, remove, and replace electric fan sensors; check operation.
  21. Explore active restraint systems procedures and practices.
    - a. Inspect, remove, and replace seatbelt and shoulder harness assembly and components in accordance with manufacturer's specifications/procedures.
    - b. Inspect restraint system mounting areas for damage; repair in accordance with manufacturer's specifications/procedures.
    - c. Verify proper operation of seatbelt in accordance with manufacturer's specifications/procedures.
  22. Explore passive restraint systems.
    - a. Inspect, remove, and replace seatbelt and shoulder harness assembly and components in accordance with manufacturer's specifications/procedures.
    - b. Inspect restraint system mounting areas for damage in accordance with manufacturer's specifications and procedures.
    - c. Verify proper operation of seatbelt in accordance with manufacturer's specifications/procedures.

- d. Inspect, remove, and replace track and drive assembly, lap retractor, torso retractor, inboard buckle-lap retractor, tensioners, and knee bolster (blocker) in accordance with manufacturer's specifications/procedures.
23. Explore paint mixing, matching, and applying.
    - a. Apply single stage topcoat for refinishing.
    - b. Apply basecoat/clearcoat for panel blending or partial refinishing.
    - c. Apply basecoat/clearcoat for overall refinishing.
    - d. Denib, buff, and polish finishes where necessary.
    - e. Refinish rigid, semi-rigid, and flexible plastic parts.
    - f. Apply multi-stage (tricoat) coats for panel blending or overall refinishing.
    - g. Identify and mix paint using a formula.
    - h. Identify poor hiding colors; determine necessary action.
    - i. Tint color using formula to achieve a blendable match.
    - j. Identify alternative color formula to achieve a blendable match.
  24. Explore paint defects (causes and cures).
    - a. Identify blistering (raising of the paint surface); determine the cause(s) and correct the condition.
    - b. Identify blushing (milky or hazy formation); determine the cause(s) and correct the condition.
    - c. Identify a dry spray appearance in the paint surface; determine the cause(s) and correct the condition.
    - d. Identify the presence of fish-eyes (crater-like openings) in the finish; determine the cause(s) and correct the condition.
    - e. Identify lifting; determine the cause(s) and correct the condition.
    - f. Identify clouding (mottling and streaking in metallic finishes); determine the cause(s) and correct the condition.
    - g. Identify orange peel; determine the cause(s) and correct the condition.
    - h. Identify overspray; determine the cause(s) and correct the condition.
    - i. Identify solvent popping in freshly painted surface; determine the cause(s) and correct the condition.
    - j. Identify sags and runs in paint surface; determine the cause(s) and correct the condition.
    - k. Identify sanding marks (sandscratch swelling); determine the cause(s) and correct the condition.
    - l. Identify color difference (off-shade); determine the cause(s) and correct the condition.
    - m. Identify tape tracking; determine the cause(s) and correct the condition.
    - n. Identify low gloss condition; determine the cause(s) and correct the condition.
    - o. Identify poor adhesion; determine the cause(s) and correct the condition.
    - p. Identify paint cracking (crow's feet or line-checking, micro-checking, etc.), determine the cause(s) and correct the condition.
    - q. Identify corrosion; determine the cause(s) and correct the condition.
    - r. Identify dirt or dust in the paint surface; determine the cause(s) and correct the condition.
    - s. Identify water spotting; determine the cause(s) and correct the condition.
    - t. Identify finish damage caused by bird droppings, tree sap, and other natural causes; correct the condition.

- u. Identify die-back conditions (dulling of the paint film showing haziness); determine the cause(s) and correct the condition.
  - v. Identify chalking (oxidation); determine the cause(s) and correct the condition.
  - w. Identify bleed-through (staining); determine the cause(s) and correct the condition.
  - x. Identify pin-holing; determine the cause(s) and correct the condition.
  - y. Identify buffing-related imperfections (swirl marks, wheel burns); correct the condition.
  - z. Measure mil thickness.
25. Explain and apply final detail practices to a vehicle.
- a. Apply decals, transfers, tapes, woodgrains, pinstripes (painted and taped), etc.
  - b. Buff and polish finish to remove defects as required.

## **Program Description**

### **Computer Graphics Technology**

The Computer Graphics Technology Program is a two-year occupational program that provides instruction in the basics of graphic design and the use of computer software to produce various media including print, video, and Web page projects. The proposed program will consist of two courses for students in grades 10-12, with each course offering two Carnegie units of vocational-technical credit toward graduation. This program will prepare students for entry-level employment in screen printing, basic Web page design, and advertising layout for print publications; and to continue their studies in postsecondary educational programs.

Industry standards referenced are from the *Career Cluster Resources for Arts, A/V Technology and Communications* published by the National Association of State Directors of Career Technical Education Consortium. Additional research data used in the development of this publication were collected from a review of related literature and from surveys of local experts in business, industry, and education.

## Course Outline

### Computer Graphics Technology I

Course CIP Code: 50.0402

**Course Description:** Computer Graphics Technology I will provide an introduction to basic design concepts, typography, photography, printing, Web page development, video, animation, and presentation software. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Orientation	40
2	History and Career Orientation	7.5
3	Introduction to Graphic Computers	43
4	Basic Design Concepts	43
5	Digital Video Production	74

### Computer Graphics Technology II

Course CIP Code: 50.0403

**Course Description:** Computer Graphics Technology II will provide instruction in advanced software applications, marketing and advertising concepts, print products, Web page design, multimedia projects, and career preparation. Students in this course will be required to complete and present a series of integrated graphics design projects focusing on a common theme/issue. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Orientation and Review	29
2	Marketing/Advertising Concepts	29
3	Print Products	29
4	Advanced Software Applications	29
5	Web Page Design	74
6	Directed Individual Study	29

**Course Name:** Computer Graphics Technology I  
**Course CIP Code:** 50.0402

1. Research educational, occupational, and leadership opportunities in Computer Graphics Technology.
  - a. Review student rules and regulations for the local school.
  - b. Investigate career opportunities, standards, skills, and emerging technologies in Computer Graphics Technology.
  - c. Research educational options available in computer technology.
  - d. Update the students' career and educational plans.
  - e. Identify and describe leadership opportunities available from student youth organizations in the school and community.
2. Apply safety procedures in the computer classroom and lab.
  - a. Discuss the proper classroom and personal safety procedures to include fire extinguishers, electrical, clothing, jewelry, eye protection, etc.
  - b. Care for and use computer hardware correctly.
  - c. Handle diskettes and CDs correctly.
  - d. Explore potential health hazards when working on computer equipment.
  - e. Examine PC security procedures.
3. Describe legal implications related to the computer industry.
  - a. Discuss software copyright issues.
  - b. Examine software licensing.
  - c. Outline Internet ethics and policies.
4. Use the Internet.
  - a. Understand terminology related to locating, evaluating, and collecting information from a variety of sources.
  - b. Use browsers, search engines, and e-mail.
  - c. Evaluate web page design techniques.
  - d. Understand technology used to locate, evaluate, and collect information from a variety of sources.
5. Compare the changing purposes served by graphic design throughout history.
  - a. Research graphic design as a communication tool.
  - b. Organize and explain the evolution of graphic design as a communication tool.
6. Analyze the development of tools and technologies and their effects on the evolution of graphic design.
  - a. Discuss the developments, events, and inventions throughout history that influenced the field of graphic design.
7. Identify and discuss the hardware in the computer system.
  - a. Examine hardware appropriate to graphic design technology.
  - b. Describe the hardware related to the classroom lab.
8. Investigate various graphic design software.
  - a. Identify and compare various graphic design software.
  - b. Associate graphic design software in relation to the hardware required to run the software.
  - c. Prepare a specification plan for a stand-alone graphic computer system

9. Compare file types.
  - a. Compare various examples of file formats, uses of each, and where different file types can be acquired.
  - b. Discuss security and file storage procedures.
10. Examine various types of storage devices.
  - a. Discuss and compare storage media including floppy disk, CD-R/RW, and DVD-R/RW.
  - b. Discuss and compare other storage devices.
11. Apply basic design concepts leading to effective composition.
  - a. Explain various design techniques to include basic principles and elements of design.
  - b. Utilize available space effectively.
12. Examine color theory and use.
  - a. Explain the use of color as it relates to design.
  - b. Discuss terminology related to color.
  - c. Examine factors related to color.
13. Critique typography as a design element.
  - a. Determine appropriate font and sizes.
  - b. Critique the placement, orientation, and aesthetic quality of type as it relates to overall design of a composition.
14. Explain the imagery process.
  - a. Discuss effective imagery.
  - b. Demonstrate capturing/importing images.
15. Identify and define multimedia presentations.
  - a. Designate the purpose and target audience of the multimedia presentations.
  - b. Identify the components of the presentations.
16. Apply the properties of text construction.
  - a. Gather subject information.
  - b. Storyboard the information.
  - c. Assemble the text within the presentations.
17. Evaluate effective imagery.
  - a. Discuss effective imagery.
  - b. Demonstrate capturing/importing images.
  - c. Select and import appropriate imagery.
18. Explain the audio process.
  - a. Discuss effective use of audio.
  - b. Demonstrate capturing/importing audio.
  - c. Select and import audio.
19. Plan and prepare a multimedia production/presentation.
  - a. Review design principles.
  - b. Discuss marketing advertising strategies.
  - c. Research approved project.
  - d. Assemble components of project.
  - e. Produce the final product.
20. Produce and present a multimedia presentation.
  - a. Assemble text, imagery, and sound.
  - b. Demonstrate the text, imagery, and sound for presentations.

- c. Evaluate the presentations.
  - d. Edit the production for final version.
  - e. Make a formal presentation of the project.
  - f. Create a video to provide to a state or national community service project.
21. Present the final multimedia production/presentation.
- a. Make a formal presentation of the project.
  - b. Discuss/critique the final project.

**Course Name:** Computer Graphics Technology II  
**Course CIP Code:** 50.0403

1. Research educational, occupational, and leadership opportunities in Computer Graphics Technology on the Internet.
  - a. Review student rules and regulations for the local school.
  - b. Investigate career opportunities, standards, skills and emerging technologies in Computer Graphics Technology.
  - c. Research educational options available in computer technology
  - d. Update the students' career and educational plans.
  - e. Identify and describe leadership opportunities available from student youth organizations in the school and community.
2. Review basic principles covered in Computer Graphics Technology I.
  - a. Review graphic hardware, software, and file manipulation.
  - b. Re-examine principles of design.
  - c. Discuss typography principles previously covered.
3. Demonstrate work ethics related to graphic design.
  - a. Discuss employer expectations related to graphic design.
  - b. Discuss and demonstrate work ethics related to the individual responsibilities.
  - c. Discuss employer expectations related to graphic design.
4. Identify and define terms related to marketing/advertising.
  - a. Discuss marketing terminology.
  - b. Discuss advertising terminology.
5. Identify product and target audience.
  - a. Determine product to be marketed.
  - b. Identify the target audience.
  - c. Understand the role of advertising as it relates to current events.
  - d. Understand the techniques of persuasion used by advertisers.
6. Develop a product design.
  - a. Comprehend and illustrate branding for the product.
  - b. Develop packaging for a product.
  - c. Review and discuss how design principles relate to the product.
  - d. Prepare and present final advertising campaign.
7. Identify and discuss various print media.
  - a. Examine types and uses of each print product.
  - b. Develop the layout of an assigned print product.
  - c. Present the layout design.
8. Apply various print processes.
  - a. Examine various print formats.
  - b. Apply assigned layout to the appropriate format.
  - c. Print final layout to appropriate media.
9. Perform image manipulation and enhancement.
  - a. Review imagery process.
  - b. Employ photo manipulation.
  - c. Explore photo enhancement.
  - d. Explore special effects.

10. Discuss and apply software applications related to print products.
  - a. Explore sizing techniques.
  - b. Demonstrate text manipulation.
  - c. Explore layout capabilities.
11. Incorporate the principles of multimedia presentation production with Web page design.
  - a. Demonstrate sound Web page design principles including information, interaction, and presentation.
  - b. Examine the concepts of Web design including web safe color, appropriate fonts for internet use, and proper file format.
12. Evaluate Web page design.
  - a. Develop the layout of an assigned Web page.
  - b. Present the draft Web page designs.
  - c. Discuss and evaluate Web page designs.
  - d. Present the final Web page.
13. Apply computer graphic technology and academic skills to solve real-world problems related to science, technology, and engineering.
  - a. Analyze general problem solving strategies.
  - b. Develop critical thinking skills in solving problems.
  - c. Integrate a community service project and computer graphics technology.
14. Demonstrate employability skills.
  - a. Discuss the elements of a resume, letter of application, and job application.
  - b. Produce a resume and incorporate into portfolios.
  - c. Identify and demonstrate appropriate interview techniques.

## **Program Description**

### **Diesel Service Technology**

Diesel Service Technology is a two-year secondary program which provides students with a foundation of skills and knowledge related to the service and repair of diesel vehicles and power equipment. Students who complete the program may enter employment in an entry level position, or continue their education in a postsecondary program such as diesel technology, heavy equipment maintenance, or related areas. Students receive instruction in the maintenance and service of a variety of vehicles including small equipment, automobiles, trucks, and tractors/construction equipment.

The first year includes instruction in foundation skills/safety procedures, leadership, tool and equipment usage, measurement, basic vehicle service, brakes/hydraulic service, and electrical system service.

The second year provides students with a review of foundation skills and safety procedures, advanced leadership skills, advanced tool and equipment usage, diesel engine (performance and repair), advanced electrical systems, and steering and suspension.

The program is aligned with ASE/NATEF–2004 Medium/Heavy Truck standards. The student will receive instruction and training in: Brakes, Electrical/Electronics, Diesel, and Steering and Suspension.

## Course Outline

### Diesel Service Technology I

Course CIP Code: 47.0605

**Course Description:** Diesel Service Technology I is the entry level course of the secondary Diesel Service Technology program. Students in Diesel Service Technology I will gain foundation competencies related to safety, tool and equipment usage, measurement, brake/hydraulics and basic electrical system service. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
Unit 1:	Introduction and Orientation	3-10
Unit 2:	Safety	5-15
Unit 3:	Tools, Technical References, Measurement, and Fasteners	5-15
Unit 4:	Brakes/Basic Hydraulics	87-105
Unit 5:	Basic Electrical/Electronic Systems	170-200

### Diesel Service Technology II

Course CIP Code: 47.0609

**Course Description:** Diesel Service Technology II is a continuing course in the secondary Diesel Service Technology program. Students will gain advanced competencies in foundation skills and safety procedures, advanced leadership skills, advanced tool and equipment usage, diesel engine (performance and repair), advanced electrical systems, and steering and suspension. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
Unit 1:	Introduction, Orientation, Employability Skills, and Safety	3-10
Unit 2:	Advanced Tools, Technical References, Measurement, and Fasteners	5-15
Unit 3:	Advanced Electrical/Electronic Systems	20-25
Unit 4:	Diesel Systems and Theory	169-205
Unit 5:	Steering and Suspension Systems	73-90

**The range of hours gives instructors the flexibility to meet local scheduling requirements. Programs should choose the maximum hours allowed by their schedule.**

**Minimum hours may be applied to Diesel Service Technology I: Units 1, 2, 3 and Diesel Service Technology II: Units 1 and 2.**

**Emphasis should be placed on Diesel Service Technology I: Units 4 and 5 and Diesel Service Technology II: Units 3, 4, and 5.**

**Course Name:** Diesel Service Technology I

**Course CIP Code:** 47.0605

1. Introduce concepts and terms associated with the diesel equipment industry.
2. Describe local program and vocational/career and technical center policies and procedures.
  - a. Describe local program and vocational/career and technical center policies and procedures including dress code, attendance, academic requirements, discipline, and transportation regulations.
  - b. Compare and contrast local program policies, procedures, and expectations to industry policies, procedures, and expectations.
  - c. Preview the school technology acceptable use policy.
3. Describe employment opportunities and responsibilities.
  - a. Describe employment opportunities including potential earnings, employee benefits, job availability, place of employment, working conditions, and educational requirements.
  - b. Describe basic employee responsibilities.
4. Describe general safety rules for working in a shop/lab and industry (ongoing).
  - a. Describe how to avoid on-site accidents.
  - b. Explain the relationship between housekeeping and safety.
  - c. Explain the importance of following all safety rules and company safety policies.
  - d. Explain the importance of reporting all on-the-job injuries and accidents.
  - e. Explain the need for evacuation policies and the importance of following them.
  - f. Explain the employer's substances abuse policy and how it relates to safety.
  - g. Explain the safety procedures when working near pressurized or high temperature.
5. Identify and apply safety around diesel equipment repair operations (ongoing).
  - a. Use proper safety practices when performing diesel equipment repair operations.
  - b. Recognize and explain personal protective equipment.
  - c. Inspect and care for personal protective equipment.
6. Apply safety procedures when lifting (ongoing).
  - a. Explain lifting.
  - b. Identify and explain the procedures for lifting heavy objects.
7. Explain the Material Safety Data Sheet (MSDS) (ongoing).
  - a. Explain the function of the MSDS.
  - b. Interpret the requirements of the MSDS.
8. Apply safety procedures to fires (ongoing).
  - a. Explain the process by which fires start.
  - b. Explain fire prevention of various flammable liquids.
  - c. Explain the classes of fire and the types of extinguishers.
  - d. Select the proper fire extinguisher for different types of fires.
9. Explain safety in and around diesel equipment repair and electrical situations (ongoing).
  - a. Explain injuries when electrical contact occurs.
  - b. Explain safety around diesel equipment repair and electrical hazards.
  - c. Explain action to take when an electrical shock occurs.

10. Demonstrate safe and proper use and storage of tools and equipment in a diesel equipment repair lab.
  - a. Identify, demonstrate, and determine the safe and proper use of common hand tools including welders (arc/MIG) and oxy/fuel cutting unit, wrenches, sockets, pliers, screwdrivers, and striking tools.
  - b. Identify, demonstrate, and determine the safe and proper use of lifting and hoisting equipment.
  - c. Identify, demonstrate, and determine the safe and proper use of cleaning equipment.
  - d. Identify, demonstrate, and determine 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.
11. 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).
12. Demonstrate measurement practices used in the 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).
13. 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.
14. Explore air brake diagnosis and repair.
  - a. Identify and interpret air brake system concerns; determine necessary action.
  - b. Research applicable service information; locate and interpret identification numbers, certification, and calibration decals.
15. Explore air supply and service systems.
  - a. Evaluate customer concerns of poor stopping, air leaks, premature wear, pulling, grabbing, or dragging problems caused by supply, and service system malfunctions; determine needed action.
  - b. Check air system build-up time and determine needed action.
  - c. Drain air reservoir tanks; check for oil, water, and foreign material; determine needed action.
  - d. Inspect, adjust, and align compressor drive belts, pulleys, and tensioners; replace as needed.
  - e. Inspect and test system pressure controls: governor, unloader assembly valves, intake screens, filters, lines, hoses, and fittings; replace as needed.

- f. Inspect air compressor, air cleaner/supply; inspect oil supply and coolant lines, fittings, and mounting brackets; repair or replace as needed.
  - g. Inspect air system lines, hoses, fittings, and couplings; repair or replace as needed.
  - h. Inspect and test air tank relief (safety) valves, one-way (single) check valves, two-way (double) check valves, and manual and automatic drain valves; replace as needed.
  - i. Inspect and clean air dryer systems, filters, valves, heaters, wiring, and connectors; repair or replace as needed.
  - j. Inspect and test:
    - o Brake application (foot) valve, fittings, and mounts; adjust or replace as needed.
    - o Stop light circuit switches, wiring, and connectors; repair or replace as needed.
    - o Hand brake (trailer) control valve, lines, fittings, and mountings; repair or replace as needed.
    - o Brake relay valve; replace as needed.
    - o Quick release valves; replace as needed.
    - o Tractor protection valve; replace as needed.
    - o Emergency (spring) brake control/modulator valve(s); replace as needed.
    - o Low pressure warning devices, wiring, and connectors; replace as needed.
    - o Air pressure gauges, lines, and fittings; replace as needed.
  - k. Evaluate customer concerns of poor stopping, brake noise, premature wear, pulling, grabbing, or dragging problems caused by the foundation brake, slack adjuster, and brake chamber problems; determine needed action.
  - l. Inspect and test service brake chambers, diaphragm, clamp, spring, pushrod, clevis, and mounting brackets; repair or replace as needed.
  - m. Inspect and service manual and automatic slack adjusters; perform needed action.
  - n. Inspect camshafts, rollers, bushings, seals, spacers, retainers, brake spiders, shields, anchor pins, and springs; replace as needed.
  - o. Inspect and measure brake shoes, linings, or pads; perform needed action.
  - p. Inspect and measure brake drums and rotors; perform needed action.
  - q. Inspect and test parking (spring) brake chamber diaphragm and seals; replace parking (spring) brake chamber; dispose of removed chambers in accordance with local regulations.
  - r. Inspect and test parking (spring) brake check valves, lines, hoses, and fittings; replace as needed.
  - s. Inspect and test parking (spring) brake application and release valve; replace as needed.
  - t. Manually release (cage) and reset (uncage) parking (spring) brakes in accordance with manufacturers' recommendations.
16. Explore hydraulic brakes diagnosis and repair.
- a. Evaluate customer concerns of poor stopping, premature wear, pulling, dragging or pedal feel problems caused by the hydraulic system; determine needed action.
  - b. Check brake pedal pushrod length; adjust as needed.
  - c. Inspect and test master cylinder for internal/external leaks and damage; replace as needed.
  - d. Inspect for leaks and damage, brake lines, flexible hoses, and fittings; replace as needed.

- e. Inspect and test brake pressure differential valve and warning light circuit switch, bulbs, wiring, and connectors; repair or replace as needed.
  - f. Inspect and clean wheel cylinders; replace as needed.
  - g. Inspect and clean disc brake caliper assemblies; replace as needed.
  - h. Inspect/test brake fluid; bleed and/or flush system; determine proper fluid type.
  - i. Test and adjust brake stop light switch, bulbs, wiring, and connectors; repair or replace as needed.
  - j. Inspect and measure brake drums and rotors; perform needed action.
  - k. Inspect and measure drum brake shoes and linings; inspect mounting hardware, adjuster mechanisms, and backing plates; perform needed action.
  - l. Inspect and measure disc brake pads/linings; inspect mounting hardware; perform needed action.
  - m. Check parking brake operation; inspect parking brake application and holding devices; adjust and replace as needed.
17. Explore power assist units.
- a. Evaluate customer concerns of stopping problems caused by the brake assist (booster) system; determine needed action.
  - b. Inspect, test, repair, or replace power brake assist (booster), hoses, and control valves; determine proper fluid type.
18. Explore air and hydraulic antilock brake systems (ABS) and automatic traction control (ATC).
19. Explore general electrical systems diagnosis.
- a. Read, interpret, and diagnose electrical/electronic circuits using wiring diagrams.
  - b. Check continuity in electrical/electronic circuits using appropriate test equipment.
  - c. Check applied voltages, circuit voltages, and voltage drops in electrical/electronic circuits using a digital multimeter (DMM).
  - d. Check current flow in electrical/electronic circuits and components using a digital multimeter (DMM) or clamp-on ammeter.
  - e. Check resistance in electrical/electronic circuits and components using a digital multimeter (DMM).
  - f. Find shorts, grounds, and opens in electrical/electronic circuits.
  - g. Diagnose parasitic (key-off) battery drain problems.
  - h. Inspect and test fusible links, circuit breakers, relays, solenoids, and fuses; replace as needed.
  - i. Inspect and test spike suppression diodes/resistors; replace as needed.
20. Explore battery diagnosis and repair.
- a. Perform battery load test and determine needed action.
  - b. Determine battery state of charge using an open circuit voltage test.
  - c. Inspect, clean, and service battery and replace as needed.
  - d. Inspect and clean battery boxes, mounts, and hold downs and repair or replace as needed.
  - e. Charge battery using slow or fast charge method as appropriate.
  - f. Inspect, test, and clean battery cables and connectors and repair or replace as needed.
  - g. Jump start a vehicle using jumper cables and a booster battery or auxiliary power supply using proper safety procedures.

21. Explore starting system diagnosis and repair.
  - a. Perform starter circuit cranking voltage and voltage drop tests and determine needed action.
  - b. Inspect and test components (key switch, pushbutton, and/or magnetic switch) and wires in the starter control circuit and replace as needed.
  - c. Inspect and test starter relays and solenoids/switches and replace as needed.
  - d. Remove and replace starter and inspect flywheel ring gear or flex plate.
22. Explore charging system diagnosis and repair.
  - a. Diagnose instrument panel mounted voltmeters and/or indicator lamps that show a no charge, low charge, or overcharge condition and determine needed action.
  - b. Diagnose the cause of a no charge, low charge, or overcharge condition and determine needed action.
  - c. Inspect and replace alternator drive belts, pulleys, fans, tensioners, and mounting brackets and adjust drive belts and check alignment.
  - d. Perform charging system voltage and amperage output tests and determine needed action.
  - e. Perform charging circuit voltage drop tests and determine needed action.
  - f. Remove and replace alternator.
  - g. Inspect, repair, or replace connectors and wires in the charging circuit.
23. Explore lighting system diagnosis and repair (headlights; daytime running lights; parking, clearance, tail, cab, and instrument panel lights).
  - a. Diagnose the cause of brighter than normal, intermittent, dim, or no headlight and daytime running light (DRL) operation.
  - b. Test, aim, and replace headlights.
  - c. Test headlight and dimmer circuit switches, relays, wires, terminals, connectors, sockets, and control components; repair or replace as needed.
  - d. Inspect and test switches, bulbs/LEDs, sockets, connectors, terminals, relays and wires of parking, clearance, and taillight circuits; repair or replace as needed.
  - e. Inspect and test instrument panel light circuit switches, relays, bulbs, sockets, connectors, terminals, wires, and printed circuits/control modules; repair or replace as needed.
  - f. Inspect and test interior cab light circuit switches, bulbs, sockets, connectors, terminals, and wires; repair or replace as needed.
  - g. Inspect and test tractor-to-trailer multi-wire connector(s); repair or replace as needed.

**Course Name:** Diesel Service Technology II

**Course CIP Code:** 47.0609

1. Describe local program and vocational/career and technical center policies and procedures.
  - a. Describe local program and vocational/career and technical center policies and procedures including dress code, attendance, academic requirements, discipline, and transportation regulations.
2. Describe employment opportunities and responsibilities (ongoing).
  - a. Describe employment opportunities including potential earnings, employee benefits, job availability, place of employment, working conditions, and educational requirements.
  - b. Describe basic employee responsibilities.
  - c. Design a resume and complete a job application.
3. Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA (ongoing).
  - a. Demonstrate effective teambuilding and leadership skills.
  - b. Practice appropriate work ethics.
4. Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations (ongoing).
  - a. Define effective written, oral, and nonverbal communication skills.
  - b. Identify the impact of effective communication.
  - c. Analyze personal strengths/weaknesses in communication.
  - d. Develop a plan to improve written, oral, and nonverbal communication.
5. Discuss the history of the diesel equipment repair industry to include materials, terminology, and techniques.
6. Describe general safety rules for working in a shop/lab and industry (ongoing).
  - a. Describe how to avoid on-site accidents.
  - b. Explain the relationship between housekeeping and safety.
  - c. Explain the importance of following all safety rules and company safety policies.
  - d. Explain the importance of reporting all on-the-job injuries and accidents.
  - e. Explain the need for evacuation policies and the importance of following them.
  - f. Explain the employer's substances abuse policy and how it relates to safety.
  - g. Explain the safety procedures when working near pressurized or high temperature.
7. Identify and apply safety around automotive operations (ongoing).
  - a. Use proper safety practices when performing automotive operations.
  - b. Recognize and explain personal protective equipment.
  - c. Inspect and care for personal protective equipment.
8. Explain lifting.
  - a. Identify and explain the procedures for lifting heavy objects.
9. Explain the Material Safety Data Sheet (MSDS).
  - a. Explain the function of the MSDS.
  - b. Interpret the requirements of the MSDS.
10. Explain fires.
  - a. Explain the process by which fires start.
  - b. Explain fire prevention of various flammable liquids.
  - c. Explain the classes of fire and the types of extinguishers.

11. 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 welders (arc/MIG) and oxy/fuel cutting unit, 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.
12. 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).
13. Demonstrate measurement practices used in the 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).
  - c. Convert measurements.
14. 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.
15. Explore stoplights, turn signals, hazard lights, and backup lights.
  - a. Inspect, test, and adjust stoplight circuit switches, bulbs/LEDs, sockets, connectors, terminals, and wires; repair or replace as needed.
  - b. Inspect and test turn signal and hazard circuit flasher(s), switches, relays, bulbs/LEDs, sockets, connectors, terminals, and wires; repair or replace as needed.
  - c. Inspect, test, and adjust backup lights and warning device circuit switches, bulbs/LEDs, sockets, horns, buzzers, connectors, terminals, and wires; repair or replace as needed.
16. Explore gauges and warning devices diagnosis and repair.
  - a. Interface with vehicle's on-board computer, perform diagnostic procedure using recommended electronic diagnostic equipment and tools (including PC-based software and/or data scan tools), and determine needed action.
  - b. Diagnose the cause of intermittent, high, low, or no gauge readings and determine needed action.

- c. Inspect and test gauge circuit sending units, gauges, connectors, terminals, and wires and repair or replace as needed.
  - d. Inspect and test warning devices (lights and audible) circuit sending units, bulbs/LED's, sockets, connectors, wires, and printed circuits/control modules; repair or replace as needed.
17. Explore related electrical systems.
- a. Diagnose the cause of constant, intermittent, or no horn operation; determine needed action.
  - b. Inspect and test horn circuit relays, horns, switches, connectors, and wires; repair or replace as needed.
  - c. Diagnose the cause of constant, intermittent, or no wiper operation; diagnose the cause of wiper speed control and/or park problems; determine needed action.
  - d. Inspect and test wiper motor, resistors, park switch, relays, switches, connectors, and wires; repair or replace as needed.
  - e. Inspect wiper motor transmission linkage, arms, and blades; adjust or replace as needed.
  - f. Inspect and test windshield washer motor or pump/relay assembly, switches, connectors, terminals, and wires; repair or replace as needed.
  - g. Inspect and test heater and A/C electrical components including A/C clutches, motors, resistors, relays, switches, connectors, terminals, and wires; repair or replace as needed.
  - h. Diagnose the cause of slow, intermittent, or no power side window operation; determine needed action.
  - i. Inspect and test motors, switches, relays, connectors, terminals, and wires of power side window circuits; repair or replace as needed.
  - j. Inspect block heaters; determine needed repairs.
  - k. Inspect and test engine cooling fan electrical control components; repair or replace as needed.
18. Explore general diesel engine diagnosis by inspecting fuel, oil, and coolant levels, condition, and consumption; and determine needed action.
- a. Diagnose causes of engine fuel, oil, coolant, air, and other leaks; determine needed action.
  - b. Interpret engine noises; determine needed action.
  - c. Observe engine exhaust smoke color and quantity; determine needed action.
  - d. Perform air intake system restriction and leakage tests; determine needed action.
  - e. Perform intake manifold pressure (boost) test; determine needed action.
  - f. Perform exhaust back pressure test; determine needed action.
  - g. Perform crankcase pressure test; determine needed action.
  - h. Diagnose no cranking, cranks but fails to start, hard starting, and starts but does not continue to run problems; determine needed action.
  - i. Diagnose surging, rough operation, misfiring, low power, slow deceleration, slow acceleration, and shutdown problems; determine needed action.
  - j. Diagnose engine vibration problems; determine needed action.
  - k. Check, record, and clear electronic diagnostic (fault) codes; monitor electronic data; determine needed action.
  - l. Perform cylinder compression test; determine needed action.

19. Explore cylinder head and valve train diagnosis and repair.
  - a. Remove, clean, inspect for visible damage, and replace cylinder head(s) assembly.
  - b. Clean and inspect threaded holes, studs, and bolts for serviceability; determine needed action.
  - c. Inspect cylinder head for cracks/damage; check mating surfaces for warpage; check condition of passages; inspect core/expansion and gallery plugs; determine needed action.
  - d. Disassemble head and inspect valves, guides, seats, springs, retainers, rotators, locks, and seals; determine needed action.
  - e. Measure valve head height relative to deck and valve face-to-seat contact; determine needed action.
  - f. Inspect injector sleeves and seals; measure injector tip or nozzle protrusion; perform needed action.
  - g. Reassemble cylinder head.
  - h. Inspect, measure, and replace/reinstall overhead camshaft; measure/adjust end play and backlash.
  - i. Inspect pushrods, rocker arms, rocker arm shafts, electronic wiring harness, and brackets for wear, bending, cracks, looseness, and blocked oil passages; perform needed action.
  - j. Inspect cam followers; perform needed action.
  - k. Adjust valve clearance.
20. Explore engine block diagnosis and repair.
  - a. Remove, inspect, service, and install pans, covers, vents, gaskets, seals, and wear rings.
  - b. Disassemble, clean, and inspect engine block for cracks/damage; measure mating surfaces for warpage; check condition of passages, core/expansion, and gallery plugs; inspect threaded holes, studs, dowel pins, and bolts for serviceability; determine needed action.
  - c. Inspect cylinder sleeve counterbore and lower bore; check bore distortion; determine needed action.
  - d. Clean, inspect, and measure cylinder walls or liners for wear and damage; determine needed action.
  - e. Replace/reinstall cylinder liners and seals; check and adjust liner height (protrusion).
  - f. Inspect in-block camshaft bearings for wear and damage; determine needed action.
  - g. Inspect, measure, and replace/reinstall in-block camshaft; measure/adjust end play.
  - h. Clean and inspect crankshaft for surface cracks and journal damage; check condition of oil passages; check passage plugs; measure journal diameter; determine needed action.
  - i. Inspect main bearings for wear patterns and damage; replace as needed; check bearing clearances; check and adjust crankshaft end play.
  - j. Inspect, install, and time gear train; measure gear backlash; determine needed action.
  - k. Inspect connecting rod and bearings for wear patterns; measure pistons, pins, retainers, and bushings; perform needed action.

- l. Determine piston-to-cylinder wall clearance; check ring-to-groove clearance and end gap; install rings on pistons.
  - m. Assemble pistons and connecting rods; install in block; install rod bearings and check clearances.
  - n. Install and align flywheel housing; inspect flywheel housing(s) to transmission housing/engine mating surface(s) and measure flywheel housing face and bore runout; determine needed action.
  - o. Inspect flywheel/flexplate (including ring gear) and mounting surfaces for cracks and wear; measure runout; determine needed action.
21. Explore lubrication systems diagnosis and repair.
- a. Test engine oil pressure and check operation of pressure sensor, gauge, and/or sending unit; determine needed action.
  - b. Check engine oil level, condition, and consumption; determine needed action.
  - c. Inspect and measure oil pump, drives, inlet pipes, and pick-up screens; determine needed action.
  - d. Inspect, clean, and test oil cooler and components; determine needed action.
  - e. Inspect turbocharger lubrication system; determine needed action.
  - f. Determine proper lubricant and perform oil and filter change.
22. Explore cooling system diagnosis and repair.
- a. Check engine coolant type, level, condition, and consumption; determine needed action.
  - b. Test coolant temperature and check operation of temperature sensor, gauge, and/or sending unit; determine needed action.
  - c. Inspect and reinstall/replace pulleys, tensioners and drive belts; adjust drive belts and check alignment.
  - d. Inspect thermostat(s), bypasses, housing(s), and seals; replace as needed.
  - e. Test coolant for freeze protection and additive package concentration; adjust as needed.
  - f. Recover, flush, and refill with recommended coolant/additive package; bleed cooling system.
  - g. Inspect coolant conditioner/filter assembly for leaks; inspect valves, lines, and fittings; replace as needed.
  - h. Inspect water pump and hoses; replace as needed. i. Inspect, clean, and pressure test radiator, pressure cap, tank(s), and recovery systems; determine needed action.
  - j. Inspect thermostatic cooling fan system (hydraulic, pneumatic, and electronic) and fan shroud; replace as needed.
23. Explore air induction and exhaust systems diagnosis and repair.
- a. Check air induction system (piping, hoses, clamps, and mounting); check for air restrictions and leaks; service or replace air filter as needed.
  - b. Inspect intake manifold, gaskets, and connections; replace as needed.
  - c. Inspect exhaust manifold, piping, mufflers, exhaust after-treatment device(s), and mounting hardware; repair or replace as needed.
  - d. Inspect and test preheater/inlet air heater or glow plug system and controls; perform needed action.
  - e. Inspect and test exhaust gas recirculation (EGR) system; determine needed action.

24. Explore fuel system diagnosis and repair.
  - a. Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, supply, and return lines and fittings; determine needed action.
  - b. Inspect, clean, and test fuel transfer (lift) pump, pump drives, screens, fuel/water separators/indicators, filters, heaters, coolers, ECM cooling plates, and mounting hardware; determine needed action.
  - c. Inspect and test low pressure regulator systems (check valves, pressure regulator valves, and restrictive fittings); determine needed action.
  - d. Check fuel system for air; determine needed action; prime and bleed fuel system; check primer pump.
25. Explore mechanical fuel injection diagnosis and repair.
  - a. Inspect and adjust throttle control linkage; determine needed action.
  - b. Inspect, test, and adjust engine fuel shut-down devices and controls; determine needed action.
  - c. Inspect high pressure injection lines, hold downs, fittings, and seals; replace as needed.
26. Explore electronic fuel management system diagnosis and repair.
  - a. Inspect and test power and ground circuits and connections; measure and interpret voltage, voltage drop, amperage, and resistance readings using a digital multimeter (DMM); determine needed action.
  - b. Interface with vehicle's on-board computer; perform diagnostic procedures using recommended electronic diagnostic equipment and tools (to include PC-based software and/or data scan tools); determine needed action.
  - c. Locate and use relevant service information (to include diagnostic procedures, flow charts, and wiring diagrams).
  - d. Inspect and replace electrical connector terminals, seals, and locks.
  - e. Inspect and test switches, sensors, controls, actuator components, and circuits; adjust or replace as needed.
  - f. Using recommended electronic diagnostic tools (to include PC-based software and/or data scan tools), access and change customer parameters.
  - g. Inspect, test, and adjust electronic unit injectors (EUI); determine needed action.
  - h. Remove and install electronic unit injectors (EUI) and related components; recalibrate ECM (if applicable).
  - i. Perform cylinder contribution test utilizing recommended electronic diagnostic tool.
  - j. Perform on-engine inspections and tests on hydraulic electronic unit injectors and system electronic controls; determine needed action.
  - k. Perform on-engine inspections and tests on distributor-type injection pump electronic controls; determine needed action.
  - l. Perform on-engine inspections and tests on in-line type injection pump electronic controls; determine needed action.
  - m. Perform on-engine inspections and tests on common rail type injection systems; determine needed action.
  - n. Discuss engine compression/exhaust brakes; determine needed action.
27. Explore small engines.
  - a. Describe the operation of a small gasoline engines.
  - b. Perform service and repair of small gasoline engines.

28. Explore steering systems diagnosis and repair.
  - a. Diagnose fixed and driver adjustable steering column and shaft noise, looseness, and binding problems; determine needed action.
  - b. Inspect steering shaft U-joint(s), slip joints, bearings, bushings, and seals; inspect phase shaft U-joints; determine needed action.
  - c. Check and adjust cab mounting and ride height.
  - d. Center the steering wheel as needed.
  - e. Disable and enable supplemental restraint system (SRS) in accordance with manufacturers' procedures.
  - f. Diagnose power steering system noise, steering binding, turning effort, looseness, hard steering, overheating, fluid leakage, and fluid aeration problems; determine needed action.
  - g. Determine recommended type of power steering fluid; check level and condition; determine needed action.
  - h. Flush and refill power steering system; purge air from system.
  - i. Inspect, service, or replace power steering reservoir including filter, seals, and gaskets.
  - j. Inspect and reinstall/replace pulleys, tensioners, and drive belts; adjust drive belts and check alignment.
  - k. Inspect, adjust, or replace power steering pump, mountings, and brackets.
  - l. Inspect and replace power steering system cooler, lines, hoses, clamps/mountings, hose routings, and fittings.
  - m. Inspect, adjust, or replace linkage-assist type power steering cylinder or gear (dual system).
  - n. Inspect, adjust, repair, or replace integral type power steering gear and mountings.
  - o. Inspect and align pitman arm; replace as needed.
  - p. Inspect drag link (relay rod) and tie rod ends; adjust or replace as needed.
  - q. Inspect steering arm and levers, and linkage pivot joints; replace as needed.
  - r. Inspect clamps and retainers on cross tube/relay rod/centerlink/tie rod; position or replace as needed.
  - s. Check and adjust wheel stops.
  - t. Lubricate steering linkage joints as needed.
29. Explore suspension systems diagnosis and repair.
  - a. Inspect front axles, U-bolts, and nuts; determine needed action.
  - b. Inspect shock absorbers, bushings, brackets, and mounts; replace as needed.
  - c. Inspect leaf springs, center bolts, clips, eye bolts and bushings, shackles, slippers, insulators, brackets, and mounts; determine needed action.
  - d. Inspect torque arms, bushings, and mounts; determine needed action.
  - e. Inspect axle aligning devices such as radius rods, track bars, stabilizer bars, and related bushings, mounts, shims, and cams; determine needed action.
  - f. Inspect walking beams, center (cross) tube, bushings, mounts, load pads, and saddles/caps; replace as needed.
  - g. Measure vehicle ride height; determine needed action.
30. Explore wheel alignment diagnosis, adjustment, and repair.
  - a. Evaluate customer concerns of vehicle wandering, pulling, shimmy, hard steering, and off-center steering wheel problem(s); adjust and repair as needed.
  - b. Check camber; determine needed action.

- c. Check caster; adjust as needed.
  - d. Check toe; adjust as needed.
  - e. Check rear axle(s) alignment (thrustline/centerline) and tracking; adjust or repair as needed.
  - f. Check front axle alignment (centerline); adjust or repair as needed.
31. Explore wheels and tires diagnosis and repair.
- a. Diagnose unusual tire wear patterns, check tread depth, and check for mismatched tread design; determine needed action.
  - b. Diagnose wheel/tire vibration, shimmy, pounding, hop (tramp) problems; determine needed action.
32. Explore frame service and repair.
- a. Inspect frame and frame members for cracks, breaks, corrosion, distortion, elongated holes, looseness, and damage; determine needed repairs.
  - b. Inspect, install, or repair frame hangers, brackets, and cross members in accordance with manufacturers' recommended procedures.

## **Program Description**

### **Plastics and Polymer Science Applications**

Plastics and Polymer Science Applications I is an instructional program that introduces an individual to the field of plastics and polymer materials manufacturing. Plastics and Polymer Science Applications II is a continuation of Plastics and Polymer Science Applications I, and allows an individual to prepare for employment or continued education in the occupations of plastics and polymer materials manufacturing.

Industry standards referenced are from the *Society of the Plastics Industry*.

## Course Outline

### Plastics and Polymer Science Applications I

Course CIP Code: 48.0520

**Course Description:** Plastics and Polymer Science Applications I is an instructional program that introduces an individual to the field of plastics and polymer materials manufacturing. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Introduction and Orientation	15
2	Safety, Health, and Environmental (OSHA & EPA)	15
3	Computer Applications	40
4	Business Principles and Employability Skills	15
5	Introduction to Chemistry	30
6	Structure and Properties of Polymers	25
7	Basic Design Principles for Manufacture of Plastic Products and Tools	15
8	Processing and Applications	50
9	Recycling	15

### Plastics and Polymer Science Applications II

Course CIP Code: 48.0519

**Course Description:** Plastics and Polymer Science Applications II is a continuation of Plastics and Polymer Science Applications I, and allows an individual to prepare for employment or continued education in the occupations of plastics and polymer materials manufacturing. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Introduction and Orientation (Review)	2
2	Safety, Health, and Environmental (OSHA & EPA) (Review)	2
3	Polymer Synthesis	9
4	Polymer Processing	40
5	Quality Control	25
6	School to Work	140

**Course Name:** Plastics and Polymer Science Applications I

**Course CIP Code:** 48.0520

1. Explain local program requirements.
  - a. Describe local student handbook requirements.
  - b. Describe classroom and laboratory operation rules.
  - c. Compare and contrast classroom and laboratory operation rules to industry and employer operation rules.
2. Introduce the equipment in the laboratory.
  - a. Identify the equipment found in the laboratory.
  - b. Identify the functions of laboratory equipment.
3. Explore personality development and the classroom environment in relation to interpersonal skills, others, and the world of work.
  - a. Determine learning styles, personality styles, and multiple intelligences.
  - b. Identify forces that shape personality development including personality traits, heredity, and environment.
  - c. Conclude how personality traits affect teamwork and leadership skills.
  - d. Write an autobiography including a summary of student interest, academic strengths and deficiencies, and tips on how teachers should individualize instruction to fit their personality and learning style.
4. Explain the history and development of the plastics/polymer industry.
  - a. Describe the history and significance of polymers.
  - b. Trace the development of plastics and polymers from the early days through the present.
5. Explain career pathways, earnings, opportunities, and educational requirements in the plastics/polymer industry.
  - a. Describe earnings, educational requirements, career ladder, and trade organizations associated with the plastics and polymer manufacturing industry.
  - b. Demonstrate personality traits to apply when serving the public.
  - c. Demonstrate desirable personality traits to apply when communicating with employees, supervisors, and other employees.
  - d. Demonstrate desirable characteristics of the work ethic to apply in the plastics and polymer manufacturing industry.
6. Explain personal and general safety rules for working in plastics and polymer materials manufacturing.
  - a. Demonstrate personal safety rules for working in a shop/lab and industry.
  - b. Demonstrate general workplace safety rules.
  - c. Demonstrate procedures for safely handling heavy objects.
  - d. Describe state eye safety law, including appropriate times for wearing safety glasses.
  - e. Demonstrate safety practices for working with chemical compounds which may be corrosive, poisonous, caustic, flammable, or irritable.
  - f. Demonstrate safety practices to apply when working with fluids under pressure, machines, and equipment in the plastics industry.
7. Apply workplace environmental safety procedures.
  - a. Describe the safe use of fire extinguishers for different classes of fires.
  - b. Identify standard industry Safety Color Code.

- c. Describe factors to consider in storing and/or disposing of hazardous materials.
  - d. Identify hazardous materials that may be found on a job site and procedures for handling, avoiding, or removing them according to Occupational Safety and Health Administration (OSHA) regulations.
  - e. Review a Materials Safety Data Sheet (MSDS).
  - f. Identify Environmental Protection Agency (EPA) regulations impacting plastics and polymer materials manufacturing.
8. Explain industrial uses of computers.
    - a. Compare and contrast home computer systems to industrial design functions of computers.
    - b. Describe manufacturing and production control functions of computers.
    - c. Describe the use of computers in quality control and distribution.
    - d. Describe applications of statistical process control in the plastics and polymer science manufacturing industry.
  9. Demonstrate the ability to read a basic blueprint.
    - a. Demonstrate the ability to read the various parts of a blueprint.
    - b. Demonstrate the ability to read a variety of blueprint views.
  10. Demonstrate the ability to manage the computer operating system.
    - a. Format, label, and examine the contents of disks.
    - b. Produce files and records and transfer files between directories and subdirectories.
    - c. Produce and utilize graphics in relation to research for plastics design and production.
    - d. Perform electronic communications data transfer (e-mail).
  11. Apply the principles of Computer Assisted Design and Drafting (CADD) as applied to the plastics and polymer manufacturing industry.
    - a. Interpret and use basic CADD symbols and terms.
    - b. Apply basic CADD skills to create, edit, and print/plot 2-D and 3-D drawings.
  12. Incorporate the CADD product into the production phase of plastics and polymer manufacturing.
    - a. Design a part with appropriate draft angle.
    - b. Produce a part according to specifications.
  13. Discuss human relations and leadership.
    - a. Describe human relations.
    - b. Describe leadership.
    - c. Describe the qualities of an effective leader including positive attitude, image, decision making, communication skills, and knowledge.
    - d. Practice effective leadership skills.
    - e. Prepare a project management methodology and use it consistently.
    - f. Describe the role of SkillsUSA in developing leadership.
    - g. Participate in SkillsUSA activities.
    - h. Explain opportunities for leadership development through SkillsUSA and other professional organizations, such as the Society of the Plastics Industry (SPI).
    - i. Describe contests and awards programs.
    - j. Participate in personal development seminars.
    - k. Attend leadership conferences and conventions.
    - l. Explain national and international exchange programs.
    - m. Plan for education experience with industry.

- n. Determine opportunities for participation in personal and community development programs.
  - o. Study the SPI standards and relate to curriculum.
14. Explain and demonstrate employability skills.
- a. Describe traits of a good employee, including integrity, knowledge, courage, tactfulness, enthusiasm, unselfishness, and loyalty.
  - b. Describe ethics in the workplace.
  - c. Describe applications of total quality management.
  - d. Describe responsibility for customer service in business.
  - e. Demonstrate job seeking skills to become employed in the plastics and polymer materials manufacturing industry.
  - f. Prepare a resume containing essential information.
  - g. Complete a job application form.
  - h. Describe procedures for a job interview.
  - i. Demonstrate the role of an applicant in a job interview.
  - j. Explain personnel law as applied to employees in the plastics and polymer materials manufacturing industry.
  - k. Describe requirements of Title IX Law as it applies to equity and protection from harassment and discrimination in the workplace.
  - l. Review employment procedures as outlined by the Civil Rights Act.
  - m. Describe medical family leave act provisions.
15. Demonstrate the proper use and care of scientific equipment.
- a. Demonstrate the use of the triple beam balance and/or digital scale.
  - b. Demonstrate the identification and care for glassware.
16. Define and identify stages of matter.
- a. Diagram atomic structures to include protons, neutrons, and electrons.
  - b. Discuss atomic behaviors to include ionic bonding, covalent bonding, metallic bonding, oxidation, and reduction action.
  - c. Identify stages of matter.
17. Define and demonstrate mixtures.
- a. Define and demonstrate a homogeneous mixture.
  - b. Define and demonstrate a heterogeneous mixture.
18. Identify the components of a solution
- a. Identify the components of a saturated solution.
  - b. Identify the components of a supersaturated solution.
19. Illustrate the importance of understanding organic chemistry in relation to polymer science.
- a. Define organic chemistry in terms of carbon bondry patterns, such as single, double, and triple bonding patterns.
  - b. Illustrate the three structural carbon formations—straight, branched, and ring.
20. Describe polymer chemistry and raw materials used in the manufacture of plastics/polymer products.
- a. Demonstrate structure of monomers.
  - b. Demonstrate structure of homopolymers and their synthesis.
  - c. Demonstrate structure of copolymers and their synthesis.
  - d. Differentiate between natural and synthetic polymers.

21. Explain types of polymers (natural and synthetic).
  - a. Describe natural polymers (cellulose, DNA/RNA, natural rubber, starches, proteins).
  - b. Describe synthetic polymers (plastics, thermoplastics, thermosets, fibers, films, elastomers, adhesives).
  - c. Research the history of polymer chemistry.
  - d. Demonstrate properties of natural polymers.
  - e. Demonstrate properties of synthetic polymers.
22. Explain rheology/viscosity.
  - a. Research the history of rheology/viscosity.
  - b. Explain the importance of rheology/viscosity.
  - c. Demonstrate polymer melt rheology.
23. Explain identification and uses of polymers.
  - a. Identify types of materials.
  - b. Identify uses of materials.
24. Explain compounding/formulation.
  - a. Explain how compounding can change the properties of polymers by using additives or modifiers.
  - b. Demonstrate how compounding/formulation can change the properties of polymers.
25. Explain geometry as applied to design of plastic products and tools.
  - a. Describe draft angle.
  - b. Calculate and measure wall thickness.
  - c. Demonstrate the importance of ribs in relation to wall thickness.
  - d. Demonstrate the importance of fillets and rounds.
26. Explain the major types of resins or materials.
  - a. Identify the major types of resins: thermoplastics, thermosets, and recycled plastics.
  - b. Explain when to use each.
27. Explain each manufacturing process and be able to identify parts made from each thermoplastic process.
  - a. Describe and demonstrate injecting molding.
  - b. Describe and demonstrate extrusion processes.
  - c. Describe and demonstrate blow molding.
  - d. Describe and demonstrate thermoforming.
  - e. Describe and demonstrate rotational molding.
28. Explain each manufacturing process and be able to identify parts made from each thermoset process.
  - a. Describe and demonstrate foam processing.
  - b. Describe and demonstrate composites production.
  - c. Describe compression molding.
29. Explain the principles of recycling.
  - a. Identify the different types of plastics and their recycle code including PETE, HDPE, V, LDPE, PP, PS, and others.
  - b. Compare the cost of recycling versus manufacture of new parts.
  - c. Describe post recycling uses for the different types of plastics.

**Course Name:** Plastics and Polymer Science Applications II

**Course CIP Code:** 48.0519

1. Explain local program requirements.
  - a. Describe local student handbook requirements.
  - b. Describe classroom and laboratory operation rules.
2. Explain the history and development of the plastics/polymer industry.
  - a. Describe the history and significance of polymers.
  - b. Trace the development of plastics and polymers from the early days through the present.
3. Explain career pathways, earnings opportunities, and educational requirements in the plastics/polymer industry.
  - a. Describe earnings, educational requirements, career ladder, and trade organizations associated with the plastics and polymer manufacturing industry.
  - b. Demonstrate personality traits to apply when serving the public.
  - c. Demonstrate desirable personality traits to apply when communicating with employees, supervisors, and other employees.
  - d. Demonstrate desirable characteristics of the work ethic to apply in the plastics and polymer manufacturing industry.
4. Become oriented to the laboratory and equipment.
  - a. Identify the equipment found in the laboratory.
  - b. Identify the functions of laboratory equipment.
5. Explain personal and general safety rules for working in plastics and polymer materials manufacturing.
  - a. Demonstrate personal safety rules for working in a shop/lab and industry.
  - b. Demonstrate general workplace safety rules.
  - c. Demonstrate procedures for safely handling heavy objects.
  - d. Describe state eye safety law, including appropriate times for wearing safety glasses.
  - e. Demonstrate safety practices for working with chemical compounds which may be corrosive, poisonous, caustic, flammable, or irritable.
  - f. Demonstrate safety practices to apply when working with fluids under pressure, machines, and equipment in the plastics industry.
  - g. Discuss Society of the Plastics Industry safety section.
6. Apply workplace environmental safety procedures.
  - a. Describe the safe use of fire extinguishers for different classes of fires.
  - b. Identify standard industry Safety Color Code.
  - c. Describe factors to consider in storing and/or disposing of hazardous materials.
  - d. Identify hazardous materials that may be found on a job site and procedures for handling, avoiding, or removing them according to Occupational Safety and Health Administration (OSHA) regulations.
  - e. Review a Materials Safety Data Sheet (MSDS).
  - f. Identify Environmental Protection Agency (EPA) regulations impacting plastics and polymer materials manufacturing.
7. Explain polymer synthesis.
  - a. Describe different types of polymer synthesis.

- b. Demonstrate different types of polymer synthesis to include condensation, addition, and/or ionic.
8. Compare and contrast different polymer processes.
  - a. Explain the process.
  - b. Demonstrate how to perform each process where equipment is available.
9. Explain the principles of rheology/viscosity as applied to quality control.
  - a. Describe uses of the melt index.
  - b. Demonstrate melt index.
10. Explain the qualities of impact and tensile strength.
  - a. Demonstrate tests for impact resistance.
  - b. Demonstrate tests for tensile strength.
11. Explain the qualities of abrasion and wear resistance.
  - a. Demonstrate tests for abrasion resistance.
  - b. Demonstrate tests for wear resistance.
12. Explain the effects of the environment on the quality of the performance of the product.
  - a. Describe tests for qualities of performance in the environment.
  - b. Demonstrate tests for measurement of performance in the environment.
13. Explain tests for dimensional quality.
  - a. Demonstrate tests for dimensional quality.
14. Describe International Standards Organization (ISO) 9000 procedures.
15. Apply technical skills needed to be a viable member of the workforce.
  - a. Prepare a description of technical skills to be developed in the supervised work experience program.
  - b. Develop technical skills needed to be a viable member of the workforce.
16. Apply human relationship skills.
  - a. Use proactive human relationship skills in the supervised work experience program.
17. Work with instructor and employer to develop, assess, and document performance of written occupational objectives to be accomplished.
  - a. Develop and follow a set of written guidelines for the supervised work experience program.
  - b. Perform written occupational objectives in the supervised work experience program.
  - c. Prepare daily written assessment of accomplishment of objectives.
  - d. Present weekly written reports to instructor in activities performed and objectives accomplished.

## Appendix A: Academic Standards

### Algebra I<sup>1</sup>

#### Competencies and Suggested Objective(s)

- A1 Recognize, classify, and use real numbers and their properties.
- Describe the real number system using a diagram to show the relationships of component sets of numbers that compose the set of real numbers.
  - Model properties and equivalence relationships of real numbers.
  - Demonstrate and apply properties of real numbers to algebraic expressions.
  - Perform basic operations on square roots excluding rationalizing denominators.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- Analyze relationships between two variables, identify domain and range, and determine whether a relation is a function.
  - Explain and illustrate how change in one variable may result in a change in another variable.
  - Determine the rule that describes a pattern and determine the pattern given the rule.
  - Apply patterns to graphs and use appropriate technology.
- A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
- Solve, check, and graph linear equations and inequalities in one variable, including rational coefficients.
  - Graph and check linear equations and inequalities in two variables.
  - Solve and graph absolute value equations and inequalities in one variable.
  - Use algebraic and graphical methods to solve systems of linear equations and inequalities.
  - Translate problem-solving situations into algebraic sentences and determine solutions.
- A4 Explore and communicate the characteristics and operations of polynomials.
- Classify polynomials and determine the degree.
  - Add, subtract, multiply, and divide polynomial expressions.
  - Factor polynomials using algebraic methods and geometric models.
  - Investigate and apply real-number solutions to quadratic equations algebraically and graphically.
  - Use convincing arguments to justify unfactorable polynomials.
  - Apply polynomial operations to problems involving perimeter and area.

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<sup>1</sup> *Mississippi mathematics framework—Algebra I*. (2003). Retrieved September 10, 2003, from [http://www.mde.k12.ms.us/curriculum/index\\_1.htm](http://www.mde.k12.ms.us/curriculum/index_1.htm)

- A5 Utilize various formulas in problem-solving situations.
- Evaluate and apply formulas (e.g., circumference, perimeter, area, volume, Pythagorean Theorem, interest, distance, rate, and time).
  - Reinforce formulas experimentally to verify solutions.
  - Given a literal equation, solve for any variable of degree one.
  - Using the appropriate formula, determine the length, midpoint, and slope of a segment in a coordinate plane.
  - Use formulas (e.g., point-slope and slope-intercept) to write equations of lines.
- A6 Communicate using the language of algebra.
- Recognize and demonstrate the appropriate use of terms, symbols, and notations.
  - Distinguish between linear and non-linear equations.
  - Translate between verbal expressions and algebraic expressions.
  - Apply the operations of addition, subtraction, and scalar multiplication to matrices.
  - Use scientific notation to solve problems.
  - Use appropriate algebraic language to justify solutions and processes used in solving problems.
- A7 Interpret and apply slope as a rate of change.
- Define slope as a rate of change using algebraic and geometric representations.
  - Interpret and apply slope as a rate of change in problem-solving situations.
  - Use ratio and proportion to solve problems including direct variation ( $y=kx$ ).
  - Apply the concept of slope to parallel and perpendicular lines.
- A8 Analyze data and apply concepts of probability.
- Collect, organize, graph, and interpret data sets, draw conclusions, and make predictions from the analysis of data.
  - Define event and sample spaces and apply to simple probability problems.
  - Use counting techniques, permutations, and combinations to solve probability problems.

## **Biology I<sup>2</sup>**

### **Competencies and Suggested Objective(s)**

- B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
- Demonstrate the proper use and care for scientific equipment used in biology.
  - Observe and practice safe procedures in the classroom and laboratory.
  - Apply the components of scientific processes and methods in the classroom and laboratory investigations.

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<sup>2</sup> *Mississippi science framework—Biology I*. (2003). Retrieved September 10, 2003, from [http://www.mde.k12.ms.us/curriculum/index\\_1.htm](http://www.mde.k12.ms.us/curriculum/index_1.htm)

- d. Communicate results of scientific investigations in oral, written, and graphic form.
- B2 Investigate the biochemical basis of life.
- a. Identify the characteristics of living things.
  - b. Describe and differentiate between covalent and ionic bonds using examples of each.
  - c. Describe the unique bonding and characteristics of water that makes it an essential component of living systems.
  - d. Classify solutions using the pH scale and relate the importance of pH to organism survival.
  - e. Compare the structure, properties and functions of carbohydrates, lipids, proteins and nucleic acids in living organisms.
  - f. Explain how enzymes work and identify factors that can affect enzyme action.
- B3 Investigate cell structures, functions, and methods of reproduction.
- a. Differentiate between prokaryotic and eukaryotic cells.
  - b. Distinguish between plant and animal (eukaryotic) cell structures.
  - c. Identify and describe the structure and basic functions of the major eukaryotic organelles.
  - d. Describe the way in which cells are organized in multicellular organisms.
  - e. Relate cell membrane structure to its function in passive and active transport.
  - f. Describe the main events in the cell cycle and cell mitosis including differences in plant and animal cell divisions.
  - g. Relate the importance of meiosis to sexual reproduction and the maintenance of chromosome number.
  - h. Identify and distinguish among forms of asexual and sexual reproduction.
- B4 Investigate the transfer of energy from the sun to living systems.
- a. Describe the structure of ATP and its importance in life processes.
  - b. Examine, compare, and contrast the basic processes of photosynthesis and cellular respiration.
  - c. Compare and contrast aerobic and anaerobic respiration.
- B5 Investigate the principles, mechanisms, and methodology of classical and molecular genetics.
- a. Compare and contrast the molecular structures of DNA and RNA as they relate to replication, transcription, and translation.
  - b. Identify and illustrate how changes in DNA cause mutations and evaluate the significance of these changes.
  - c. Analyze the applications of DNA technology (forensics, medicine, agriculture).
  - d. Discuss the significant contributions of well-known scientists to the historical progression of classical and molecular genetics.
  - e. Apply genetic principles to solve simple inheritance problems including monohybrid crosses, sex linkage, multiple alleles, incomplete dominance, and codominance.
  - f. Examine inheritance patterns using current technology (gel electrophoresis, pedigrees, karyotypes).

- B6 Investigate concepts of natural selection as they relate to diversity of life.
- Analyze how organisms are classified into a hierarchy of groups and subgroups based on similarities and differences.
  - Identify characteristics of kingdoms including monerans, protists, fungi, plants and animals.
  - Differentiate among major divisions of the plant and animal kingdoms (vascular/non-vascular; vertebrate/invertebrate).
  - Compare the structures and functions of viruses and bacteria relating their impact on other living organisms.
  - Identify evidence of change in species using fossils, DNA sequences, anatomical and physiological similarities, and embryology.
  - Analyze the results of natural selection in speciation, diversity, adaptation, behavior and extinction.
- B7 Investigate the interdependence and interactions that occur within an ecosystem.
- Analyze the flow of energy and matter through various cycles including carbon, oxygen, nitrogen and water cycles.
  - Interpret interactions among organisms in an ecosystem (producer/consumer/decomposer, predator/prey, symbiotic relationships and competitive relationships).
  - Compare variations, tolerances, and adaptations of plants and animals in major biomes.
  - Investigate and explain the transfer of energy in an ecosystem including food chains, food webs, and food pyramids.
  - Examine long and short-term changes to the environment as a result of natural events and human actions.

### **English II<sup>3</sup>**

#### **Competencies and Suggested Objective(s)**

- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
- Produce individual and/or group compositions and/or projects to persuade, tell a story, describe, create an effect, explain or justify an action or event, inform, entertain, etc.
  - Produce writing typically used in the workplace such as social, business, and technical correspondence; explanation of procedures; status reports; research findings; narratives for graphs; justification of decisions, actions, or expenses; etc.
  - Write a response, reaction, interpretation, analysis, summary, etc., of literature, other reading matter, or orally presented material.
  - Revise to ensure effective introductions, details, wording, topic sentences, and conclusions.

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<sup>3</sup> *Mississippi language arts framework—English II*. (2003). Retrieved September 10, 2003, from [http://www.mde.k12.ms.us/curriculum/index\\_1.htm](http://www.mde.k12.ms.us/curriculum/index_1.htm)

- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- Listen to determine the main idea and supporting details, to distinguish fact from opinion, and to determine a speaker's purpose or bias.
  - Speak with appropriate intonation, articulation, gestures, and facial expression.
  - Speak effectively to explain and justify ideas to peers, to inform, to summarize, to persuade, to entertain, to describe, etc.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
- Read, view, and listen to distinguish fact from opinions and to recognize persuasive and manipulative techniques.
  - Access both print and non-print sources to produce an I-Search paper, research paper, or project.
  - Use computers and audio-visual technology to access and organize information for purposes such as resumes, career search projects, and analytical writings, etc.
  - Use reference sources, indices, electronic card catalog, and appropriate research procedures to gather and synthesize information.
- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- Interact with peers to examine real world and literary issues and ideas.
  - Show growth in critical thinking, leadership skills, consensus building, and self-confidence by assuming a role in a group, negotiating compromise, and reflecting on individual or group work.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- Share, critique, and evaluate works in progress and completed works through a process approach.
  - Communicate effectively in a group to present completed projects and/or compositions.
  - Edit oral and written presentations to reflect correct grammar, usage, and mechanics.
- E6 Explore cultural contributions to the history of the English language and its literature.
- Explore a variety of works from various historical periods, geographical locations, and cultures, recognizing their influence on language and literature.
  - Identify instances of dialectal differences which create stereotypes, perceptions, and identities.
  - Recognize root words, prefixes, suffixes, and cognates.
  - Relate how vocabulary and spelling have changed over time.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- Listen to and read aloud selected works to recognize and respond to the rhythm and power of language to convey a message.

- b. Read aloud with fluency and expression.
  - c. Analyze the stylistic devices, such as alliteration, assonance, word order, rhyme, onomatopoeia, etc., that make a passage achieve a certain effect.
  - d. Demonstrate how the use of language can confuse or inform, repel or persuade, or inspire or enrage.
  - e. Analyze how grammatical structure or style helps to create a certain effect.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- a. Read and explore increasingly complete works, both classic and contemporary, for oral discussion and written analysis.
  - b. Read, discuss, and interpret literature to make connections to life.
  - c. Read from a variety of genres to understand how the literary elements contribute to the overall quality of the work.
  - d. Identify qualities in increasingly complex literature that have produced a lasting impact on society.
  - e. Read for enjoyment, appreciation, and comprehension of plot, style, vocabulary, etc.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- a. Infuse the study of grammar and vocabulary into written and oral communication.
  - b. Demonstrate, in the context of their own writing, proficient use of the conventions of standard English, including, but not limited to, the following: complete sentences, subject-verb agreement, plurals, spellings, homophones, possessives, verb forms, punctuation, capitalization, pronouns, pronoun-antecedent agreement, parallel structure, and dangling and misplaced modifiers.
  - c. Give oral presentations to reinforce the use of standard English.
  - d. Employ increasingly proficient editing skills to identify and solve problems in grammar, usage, and structure.
- E10 Use language and critical thinking strategies to serve as tools for learning.
- a. Use language to facilitate continuous learning, to record observations, to clarify thought, to synthesize information, and to analyze and evaluate language.
  - b. Interpret visual material orally and in writing.

## U. S. History from 1877<sup>4</sup>

### Competencies and Suggested Objective(s)

- H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
- Apply economic concepts and reasoning when evaluating historical and contemporary social developments and issues (e.g., gold standard, free coinage of silver, tariff issue, laissez faire, deficit spending, etc.).
  - Explain the emergence of modern America from a domestic perspective (e.g., frontier experience, Industrial Revolution and organized labor, reform movements of Populism and Progressivism, Women’s Movement, Civil Rights Movement, the New Deal, etc.).
  - Explain the changing role of the United States in world affairs since 1877 through wars, conflicts, and foreign policy (e.g., Spanish-American War, Korean conflict, containment policy, etc.).
  - Trace the expansion of the United States and its acquisition of territory from 1877 (e.g., expansionism and imperialism).
- H2 Describe the impact of science and technology on the historical development of the United States in the global community.
- Analyze the impact of inventions on the United States (e.g., telephone, light bulb, etc.).
  - Examine the continuing impact of the Industrial Revolution on the development of our nation (e.g., mass production, computer operations, etc.).
  - Describe the effects of transportation and communication advances since 1877.
- H3 Describe the relationship of people, places, and environments through time.
- Analyze human migration patterns since 1877 (e.g., rural to urban, the Great Migration, etc.).
  - Analyze how changing human, physical, geographic characteristics can alter a regional landscape (e.g., urbanization, Dust Bowl, etc.).
- H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
- Interpret special purpose maps, primary/secondary sources, and political cartoons.
  - Analyze technological information on graphs, charts, and timelines.
  - Locate areas of international conflict (e.g., Caribbean, Southeast Asia, Europe, etc.).
- H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.
- Examine various reform movements (e.g., Civil Rights, Women’s Movement, etc.).

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<sup>4</sup> *Mississippi social studies framework—U.S. History from 1877*. (2003). Retrieved September 10, 2003, from [http://www.mde.k12.ms.us/curriculum/index\\_1.htm](http://www.mde.k12.ms.us/curriculum/index_1.htm)

- b. Examine the government's role in various movements (e.g., arbitration, 26th Amendment, etc.).
- c. Examine the role of government in the preservation of citizens' rights (e.g., 19th Amendment, Civil Rights Act of 1964).
- d. Examine individuals' duties and responsibilities in a democratic society (e.g., voting, volunteerism, etc.).

## Appendix B: 21<sup>st</sup> Century Skills<sup>5</sup>

### CS1 Global Awareness

- Using 21<sup>st</sup> century skills to understand and address global issues
- Learning from and working collaboratively with individuals representing diverse cultures, religions, and lifestyles in a spirit of mutual respect and open dialogue in personal, work, and community contexts
- Promoting the study of non-English language as a tool for understanding other nations and cultures

### CS2 Financial, Economic, and Business Literacy

- Knowing how to make appropriate personal economic choices
- Understanding the role of the economy and the role of business in the economy
- Applying appropriate 21<sup>st</sup> century skills to function as a productive contributor within an organizational setting
- Integrating oneself within and adapting continually to our nation's evolving economic and business environment

### CS3 Civic Literacy

- Being an informed citizen to participate effectively in government
- Exercising the rights and obligations of citizenship at local, state, national, and global levels
- Understanding the local and global implications of civic decisions
- Applying 21<sup>st</sup> century skills to make intelligent choices as a citizen

### CS4 Information and Communication Skills

- Information and media literacy skills: Analyzing, accessing, managing, integrating, evaluating, and creating information in a variety of forms and media; understanding the role of media in society
- Communication skills: Understanding, managing, and creating effective oral, written, and multimedia communication in a variety of forms and contexts

### CS5 Thinking and Problem-Solving Skills

- Critical thinking and systems thinking: Exercising sound reasoning in understanding and making complex choices, understanding the interconnections among systems
- Problem identification, formulation, and solution: Ability to frame, analyze, and solve problems
- Creativity and intellectual curiosity: Developing, implementing, and communicating new ideas to others, staying open and responsive to new and diverse perspectives

### CS6 Interpersonal and Self-Directional Skills

- Interpersonal and collaborative skills: Demonstrating teamwork and leadership, adapting to varied roles and responsibilities, working productively with others, exercising empathy, respecting diverse perspectives
- Self-direction: Monitoring one's own understanding and learning needs, locating appropriate resources, transferring learning from one domain to another

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<sup>5</sup> 21<sup>st</sup> century skills. (n.d.). Washington, DC: Partnership for 21<sup>st</sup> Century Skills.

- Accountability and adaptability: Exercising personal responsibility and flexibility in personal, workplace, and community contexts; setting and meeting high standards and goals for one's self and others; tolerating ambiguity
- Social responsibility: Acting responsibly with the interests of the larger community in mind; demonstrating ethical behavior in personal, workplace, and community contexts