

Illinois Career Programs in STEM and Manufacturing



Programs in this matrix belong to three unique career clusters: Science, Technology, Engineering and Math (STEM), Energy, and Manufacturing. STEM career programs are focused on planning, managing and providing scientific research and professional and technical services (e.g., physical science, social science, engineering) including laboratory and testing services, and research and development services. Energy career programs are focused on the varying sources, methods of delivery, and multiple uses of energy. Manufacturing career programs are focused on planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing, and process engineering. All career and technical education programs provide students opportunities for practical application of academic concepts. The Strengthening Career and Technical Education for the 21st Century Act (Perkins V) emphasizes student achievement in science, English language arts, and mathematics. To assist local education agencies in selecting courses best suited for this purpose, specific CTE courses with emphasis on these subjects have been highlighted below. Courses best suited for science applications are shown in yellow, mathematics are shown in blue, and English language arts are shown in orange. Local boards of education may allow CTE courses to be substituted for graduation requirements. Refer to [105 Illinois Compiled Statutes 5/27-22](#) and [105 ILCS 5/27-22.05](#) for more information.

Science Applications	Math Applications	ELA Applications
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CAREER CLUSTER	Science, Technology, Engineering, & Mathematics	Energy	Manufacturing	Manufacturing	Manufacturing	Manufacturing	Manufacturing
CIP	15.0000	15.1701	47.0105	48.0501	48.0506	48.0508	48.0703
TEACHER LICENSURE ENDORSEMENT	PEL with TEED (Technology Education) ELS with SENS (STEM & Energy Systems)	PEL with TEED (Technology Education) ELS with SENS (STEM & Energy Systems)	PEL with TEED (Technology Education) ELS with MIEL (Industrial Electronics)	PEL with TEED (Technology Education) ELS with MNMC (Machinist)	PEL with TEED (Technology Education) ELS with ACHV (HVAC) ELS with MSWK (Sheet-working)	PEL with TEED (Technology Education) ELS with MWEL (Welding Technology)	PEL with TEED (Technology Education) ELS with MCAB (Cabinetmaking)
PATHWAY	Engineering Technology, General	Energy Systems Technology/Technician.	Industrial Electronics Technology/Technician	Machine Tool Technology/ Machinist	Sheet Metal Technology/ Sheet-working	Welding Technology/ Welder	Cabinetmaking and Millwork
GROUP 1: ORIENTATION COURSES (Minimum Selection: One course from Group 1 or 2)							
ORIENTATION COURSES	Career Exploration 22151A001	Career Exploration 22151A001	Career Exploration 22151A001	Career Exploration 22151A001	Career Exploration 22151A001	Career Exploration 22151A001	Career Exploration 22151A001
	Introduction to Technology and Engineering (Industrial) 21052A002	Introduction to Technology and Engineering (Industrial) 21052A002	Introduction to Technology and Engineering (Industrial) 21052A002	Introduction to Technology and Engineering (Industrial) 21052A002	Introduction to Technology and Engineering (Industrial) 21052A002	Introduction to Technology and Engineering (Industrial) 21052A002	Introduction to Technology and Engineering (Industrial) 21052A002
	Transportation Technology 20001A001	Transportation Technology 20001A001	Exploration of Manufacturing Occupations 13001A001	Exploration of Manufacturing Occupations 13001A001	Exploration of Manufacturing Occupations 13001A001	Exploration of Manufacturing Occupations 13001A001	Exploration of Manufacturing Occupations 13001A001
	Production Technology 13052A001	Production Technology 13052A001	Production Technology 13052A001	Production Technology 13052A001	Production Technology 13052A001	Production Technology 13052A001	Production Technology 13052A001
	Communication Technology 11002A001	Communication Technology 11002A001	Communication Technology 11002A001	Communication Technology 11002A001	Communication Technology 11002A001	Communication Technology 11002A001	Communication Technology 11002A001
	Energy Utilization Technology 20101A001	Energy Utilization Technology 20101A001	Energy Utilization Technology 20101A001	Energy Utilization Technology 20101A001	Energy Utilization Technology 20101A001	Energy Utilization Technology 20101A001	Energy Utilization Technology 20101A001
			Transportation Technology 20001A001	Transportation Technology 20001A001	Transportation Technology 20001A001	Transportation Technology 20001A001	Transportation Technology 20001A001

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CAREER CLUSTER	Science, Technology, Engineering, & Mathematics	Energy	Manufacturing	Manufacturing	Manufacturing	Manufacturing	Manufacturing
CIP	15.0000	15.1701	47.0105	48.0501	48.0506	48.0508	48.0703
GROUP 2: INTRODUCTORY COURSES							
INTRODUCTORY COURSES	Foundations of Technology 21052A001	Foundations of Technology 21052A001	Foundations of Technology 21052A001	Foundations of Technology 21052A001	Foundations of Technology 21052A001	Foundations of Technology 21052A001	Foundations of Technology 21052A001
	Industrial Safety 13004A001	Industrial Safety 13004A001	Industrial Safety 13004A001	Industrial Safety 13004A001	Industrial Safety 13004A001	Industrial Safety 13004A001	Industrial Safety 13004A001
	Introduction to Engineering Design 21006A001	Beginning Electricity 17102A005	Blueprint Reading 21108A001	Beginning Welding 13207A003	Blueprint Reading 21108A001	Beginning Welding 13207A003	Beginning Cabinetmaking 17007A003
	Blueprint Reading 21108A001	Blueprint Reading 21108A001	Beginning Electricity 17102A005	Blueprint Reading 21108A001		Blueprint Reading 21108A001	Blueprint Reading 21108A001
	Geometry in Construction 17017A002			Beginning Drafting 21102A002			Geometry in Construction 17017A002
				Beginning Machining 13203A007			
GROUP 3: SKILLS COURSE (Minimum Selection 1)							
SKILLS COURSES	Principles of Engineering 21004A001	Energy & Power 20101A002	Industrial Electronics I 17104A001	Machine Tool Technology/Machinist I 13203A001	Sheet Metal Technology I 13205A001	Welding Technology I 13207A001	Cabinetmaking & Millwork I 17007A001
	Principles of Technology I 21001A001		Industrial Maintenance I 13302A001	Precision Metal Production I 13055A001			
	Technological Design and Innovation 21054A001			Machine Shop Technology I 13203A005			
				Computer Integrated Manufacturing 21010A001			
GROUP 4: ADVANCED COURSES							
ADVANCED COURSES	Principles of Technology II 21001A002	Principles of Technology II 21001A002	Industrial Electronics II 17104A002	Machine Tool Technology/Machinist II 13203A002	Sheet Metal Technology II 13205A002	Welding Technology II 13207A002	Cabinetmaking & Millwork II 17007A002
	Engineering Design 21006A002	Industrial Electronics II 17104A002	Industrial Maintenance II 13302A002	Machine Shop Technology II 13203A006			
	Robotics 21009A001	Wind Turbine Maintenance 21061A001	Mechatronics 13102A001	Robotics 21009A001			
	Emerging Technologies 21053A001	Emerging Technologies 21053A001	Wind Turbine Maintenance 21061A001	Precision Metal Production II 13055A002			
	Technology, Society, and Sustainability 21054A004	Technology, Society, and Sustainability 21054A004	Digital Electronics 21008A001	Emerging Technologies 21053A001			
	Aerospace Engineering 21013A001	Alternative Energy 18506A001					
	Digital Electronics 21008A001	Digital Electronics 21008A001					

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CAREER CLUSTER	Science, Technology, Engineering, & Mathematics	Energy	Manufacturing	Manufacturing	Manufacturing	Manufacturing	Manufacturing
CIP	15.0000	15.1701	47.0105	48.0501	48.0506	48.0508	48.0703
ADVANCED COURSES CONTINUED	Biotechnical Engineering 21014A001						
	Civil Engineering and Architecture 21012A001						

GROUP 5: WORKPLACE EXPERIENCE COURSES

WORKPLACE EXPERIENCE	STEM Workplace Experience 21998A001	Energy Workplace Experience 21098A002	Manufacturing Workplace Experience 13998A002	Manufacturing Workplace Experience 13998A002	Manufacturing Workplace Experience 13998A002	Manufacturing Workplace Experience 13998A002	Manufacturing Workplace Experience 13998A002
	Engineering Workplace Experience 21048A001	Energy Systems Technology Workplace Experience 21098A001	Industrial Electronics Workplace Experience 13998A001	Machine Tool Technology Workplace Experience 13148A001	Sheet-working Workplace Experience 13248A001	Welding Workplace Experience 13248A002	Cabinetmaking Workplace Experience 13098A001

A quality CTE program delivers all required elements of Illinois' definition of Size, Scope, Quality. CTE program elements include: a sequence of courses, each educational entity offering approved courses provides assurance that the course content includes at a minimum the State course description, meets the State's minimum requirements for course offerings by program, curriculum aligned to state recognized learning standards & industry standards, career pathway guidance, resources to support program/course delivery (licensed & qualified staff, appropriate facilities, adequate equipment, instructional materials, work-based learning experiences, special populations support services, an active affiliated CTSO chapter), articulation/dual credit agreements, documentation of state agency certification or licensing requirements for occupations regulated by law or licensure, & content which prepare students for reflective of current labor & opportunity for workplace experience or a structured capstone course. Orientation courses are suggested to be taught at the prior-to-secondary or 9th grade levels. Introductory level courses are suggested to be taught at the 9th-11th grade level. Skill level courses are suggested to be taught at the 10th – 12th grade levels. Workplace Experiences Courses are suggested to be taught at the 12th grade level.

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Group	State Course Code	State Course Title	State Course Description
Group 1	22151A001	Career Exploration	Career Exploration courses help students identify and evaluate personal goals, priorities, aptitudes, and interests with the goal of helping them make informed decisions about their careers. These courses expose students to various sources of information on career and training options and may also assist them in developing job search and employability skills.
Group 1	21052A002	Introduction to Technology and Engineering (Industrial)	Introduction to Technology & Engineering is comprised of the following areas: Production, Transportation, Communication, Energy Utilization and Engineering Design but is not limited to these areas only. This course will cover the resources, technical processes, industrial applications, material sciences, technological impact and occupations encompassed by that system.
Group 1	13052A001	Production Technology	Production Technology is a course designed to foster an awareness and understanding of manufacturing and construction technology. Through a variety of learning activities, students are exposed to many career opportunities in the production field. Experiences in manufacturing include product design, materials and processes, tools and equipment including computers, safety procedures, corporate structure, management, research and development, production planning, mass production, marketing, and servicing. In construction, students are exposed to site preparation, foundations, building structures, installing utilities, and finishing and servicing structures.
Group 1	11002A001	Communication Technology	Communication Technology is a course designed to foster an awareness and understanding of the technologies used to communicate in our modern society. Students gain experience in the areas of design and drafting, radio and television broadcasting, computers in communication, photography, graphic arts, and telecommunications.
Group 1	20001A001	Transportation Technology	Transportation Technology is a course designed to foster an awareness and understanding of the various transportation customs that make up our mobile society. Through laboratory activities, students are exposed to the technologies of and career opportunities involved in material handling, atmospheric and space transportation, marine transportation, terrestrial transportation, and computer uses in transportation technology.
Group 1	20101A001	Energy Utilization Technology	Energy Utilization Technology is a course designed to foster an awareness and understanding of how we use energy in our industrial technological society. Areas of study include conversion of energy, electrical fundamentals, solar energy resources, alternate energy resources such as wind, water, and geothermal; fossil fuels, nuclear power, energy conservation, and computer uses in energy technology. Students use laboratory experiences to become familiar with current energy technologies.
Group 1	13001A001	Exploration of Manufacturing Occupations	Exploration of Manufacturing Occupations courses introduce and expose students to the career opportunities pertaining to the processing and production of goods. Course topics vary and may include (but are not limited to) systems pertinent to the manufacturing process, properties of various raw materials, and the methods used to transform materials into consumer products. Course activities depend upon the careers being explored; course topics may include entrepreneurship, labor laws, and customer service.
Group 2	21052A001	Foundations of Technology	The course employs teaching/learning strategies that enable students to build their own understanding of new ideas. It is designed to engage students in exploring and deepening their understanding of “big ideas” regarding technology and apply technological processes to solve real problems and develop knowledge and skills to design, modify, use and apply technology in the following areas: engineering design, manufacturing technologies, construction technologies, energy & power, information & communication technologies and emerging technologies.

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Group 2	13004A001	Industrial Safety	Industrial Safety courses provide students with instruction in safe operating procedures related to various trades. Course topics may include the importance of standard operation procedures, agencies and regulations related to occupational safety and hazard prevention, and the dangers of particular materials.
Group 2	21006A001	Introduction to Engineering Design	Engineering Design courses offer students experience in solving problems by applying a design development process. Often using solid modeling computer design software, students develop, analyze, and test product solutions models as well as communicate the features of those models.
Group 2	21108A001	Blueprint Reading	Blueprint Reading courses provide students with the knowledge and ability to interpret the lines, symbols, and conventions of drafted blueprints. They generally emphasize interpreting, not producing, blueprints, although the courses may provide both types of experiences. Blueprint Reading courses typically use examples from a wide variety of industrial and technological applications.
Group 2	17017A002	Geometry and Construction	Geometry in Construction courses provide students with an integrated way to learn Geometry through the application in Construction. The construction concepts within the course are organized to compliment the skills and the knowledge that align to High School - Geometry standards. Students will apply these skills and knowledge to the completion of construction projects.
Group 2	17102A005	Beginning Electricity	Beginning Electricity—course provides a survey of the theory, terminology, equipment, and practical experience in the skills needed for careers in the electrical field. This courses typically include AC and DC circuitry, safety, and the National Electrical Code and may cover such skills as those involved in building circuits; wiring residential, installing lighting, power circuits, and cables.
Group 2	13207A003	Beginning Welding	Beginning Welding course enables students to gain knowledge of the properties, uses, and applications of various metals, skills in various processes used to join and cut metals (such as oxyacetylene, shielded metal, metal inert gas, and tungsten arc processes), and experience in identifying, selecting, and rating appropriate techniques. Welding courses often include instruction in interpreting blueprints or other types of specifications.
Group 2	21102A002	Beginning Drafting	Beginning Drafting is an introductory level drafting course. During this course students will learn the basic fundamentals of drafting and/or computer aided drafting (CAD). The instruction will include the care and use of drafting equipment, freehand sketching, orthographic projection, lettering techniques, dimensioning standards, pictorial drawings, drawing reproduction, and an introduction to CAD.
Group 2	13203A007	Beginning Machining	Beginning Machining course enable students to create metal parts using various machine tools and equipment. Course content may include interpreting specifications for machines using blueprints, sketches, or descriptions of parts; preparing and using lathes, milling machines, shapers, and grinders with skill, safety, and precision.
Group 2	17007A003	Beginning Cabinetmaking	Beginning Cabinetmaking course provides students with experience in constructing cases, cabinets, counters, and other interior woodwork. Students learn how to use various woodworking machines and power tools for cutting and shaping wood. This course can cover the different methods of joining pieces of wood, how to use mechanical fasteners, and how to attach hardware.
Group 3	21004A001	Principles of Engineering	Principles of Engineering courses provide students with an understanding of the engineering /technology field. Students typically explore how engineers use various technology systems and manufacturing processes to solve problems; they may also gain an appreciation of the social and political consequences of technological change.
Group 3	21001A001	Principles of Technology I	This course provides learning experiences related to the principles that underlie today's high technology: force, work, rate, resistance, energy, power, and force transformers. The course deals with these principles as they apply in each of the four systems that make up both the simplest and the most complex technological devices

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			and equipment: mechanical systems, fluid systems, electrical systems, and thermal systems. Learning experiences are designed to allow students to acquire knowledge and skills which are transferable to postsecondary technical programs.
Group 3	21006A002	Engineering Design	In this course, engineering scope, content, and professional practice are presented through practical applications. Students in engineering teams apply technology, science, and mathematics concepts and skills to solve engineering design problems and create innovative designs. Students research, develop, test, and analyze engineering designs using criteria such as design effectiveness, public safety, human factors, and ethics. This course is the capstone experience for students who are interested in Technology, Innovation, Design, and Engineering.
Group 3	21054A001	Technological Design and Innovation	In this course, technological design and innovation are presented through practical applications. Students apply technology, science, and mathematics concepts and skills to solve technological /engineering problems and innovative designs. Students research, develop, create simulations, test, and analyze engineering designs using criteria such as design effectiveness, public safety and human factors.
Group 3	20101A002	Energy & Power	Energy/Power courses focus on one or several aspects of energy and power in transportation and work. Course content may include various sources of energy and their use in society (for example, characteristics, availability, conversion, storage, environmental impact, and socioeconomic aspects of various energy sources); principles involved in various means of energy transfer, such as electricity/electronics, hydraulics, pneumatics, heat transfer, and wind/nuclear/solar energies; and the transmission and control of power through mechanical or electrical devices such as motors and engines.
Group 3	17104A001	Industrial Electronics I	This course introduces students to the skills needed to service, repair, and replace a wide range of equipment associated with automated or instrument-controlled manufacturing processes. Planned learning activities in this course allow students to become more knowledgeable in the fundamental principles and theories of electrical /electronic and hydraulic/pneumatic equipment as applied to instrumentation devices and digitally encoded radio equipment. Instruction also includes safety principles and practices, semi-conductors and transistor theory, electrical parameters and circuits, electronic component function and identification, and the use and care of related hand tools, power tools, and test equipment.
Group 3	13302A001	Industrial Maintenance I	This course is intended to provide students with planned learning experiences and activities that include safety, basic hand and power tools, mathematics, precision measurement, blueprint reading, introduction to electricity, basic carpentry, scaffolding and rigging, and basic welding and cutting. In addition, students are introduced to robotics and other automated manufacturing procedures.
Group 3	13203A001	Machine Tool Technology/ Machinist I	This course introduces students to the basic skills and machines needed in precision metal work. Students gain machining skills while working with lathes, milling machines, surface grinders, drill presses, and other equipment. In addition, students learn the basics of blueprint reading, precision measuring, layout, and machining process planning.
Group 3	13055A001	Precision Metal Production I	This course offers a planned sequence of learning experiences which provide students with the opportunities to develop competencies needed for employment in a variety of manufacturing-related occupations. This course introduces students to the skills common to many occupations, such as applying safety practices, selecting materials, performing bench work operations, performing precision measurement, performing layouts, performing housekeeping and recordkeeping activities, and operating a variety of tools used for separating, forming, and combining materials.

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Group 3	13203A005	Machine Shop Technology I	This course introduces students to the basic mechanical and technical skills common to most fields in the fabrication of metal parts in support of other manufacturing activities. Topics include shop safety, hand and power tool use, the operation and maintenance of precision metal working equipment, precision measurement, quality control, exploring the manufacturing process, instrumentation and blueprint reading.
Group 3	21010A001	Computer Integrated Manufacturing	Computer Integrated Manufacturing courses involve the study of robotics and automation. Building on computer solid modeling skills, students may use computer numerical control (CNC) equipment to produce actual models of their three-dimensional designs. Course topics may also include fundamental concepts of robotics, automated manufacturing, and design analysis.
Group 3	13205A001	Sheet Metal Technology I	This course is designed to introduce students to the Sheet Metal Worker occupation. Students are instructed in areas of safety including hand tool, power tool, ladder and scaffolding. Students are introduced to the planning, layout, and fabrication of sheet metal parts. Students gain knowledge of blueprint reading and sketching to determine sequence and methods of fabrication and assembly of products. In addition, units of instruction include the proper use and maintenance of hand and power tools, metal identification, measuring and layout, metal separating, forming machinery, and basic welding.
Group 3	13207A001	Welding Technology I	This course assists students in gaining the knowledge and developing the basic skills needed to be successful in welding technology. Units of instruction include arc, TIG and MIG welding, metallurgy, cutting metal using arc, plasma, and oxy -gas. In addition, students learn the basics of blueprint reading, precision measuring, layout, and production process planning.
Group 3	17007A001	Cabinetmaking & Millwork I	This course introduces students to the basic design and fabrication of residential cabinetry and custom furniture. The course also exposes students to the millwork and millwright industry. Instruction includes safety practices in using hand tools and power equipment.
Group 4	21001A002	Principles of Technology II	This course includes learning experiences related to the principles that underlie today's high technology: momentum, waves and vibrations, energy converters, transducers, radiation, optical systems, and time constraints. The course deals with these principles as they apply in each of the systems that make up both the simplest and the most complex technological devices and equipment: mechanical systems, fluid systems, electrical systems, and thermal systems. Learning experiences are designed to allow students to acquire knowledge and skills which are transferable to postsecondary technical programs.
Group 4	21006A001	Engineering Design	In this course, engineering scope, content, and professional practice are presented through practical applications. Students in engineering teams apply technology, science, and mathematics concepts and skills to solve engineering design problems and create innovative designs. Students research, develop, test, and analyze engineering designs using criteria such as design effectiveness, public safety, human factors, and ethics. This course is the capstone experience for students who are interested in Technology, Innovation, Design, and Engineering.
Group 4	21008A001	Digital Electronics	Digital Electronics courses teach students how to use applied logic in the development of electronic circuits and devices . Students may use computer simulation software to design and test digital circuitry prior to the actual construction of circuits and devices.
Group 4	21014A001	Biotechnical Engineering	Biotechnical Engineering courses enable students to develop and expand their knowledge and skills in biology, physics, technology, and mathematics. Course content may vary widely, drawing upon diverse fields such as biomedical engineering, biomolecular genetics, bioprocess engineering, agricultural biology, or environmental engineering. Students may engage in problems related to biomechanics, cardiovascular engineering, genetic

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			engineering, agricultural biotechnology, tissue engineering, biomedical devices, human interfaces, bioprocesses, forensics, and bioethics.
Group 4	21009A001	Robotics	Robotics courses develop and expand students' skills and knowledge so that they can design and develop robotic devices . Topics covered in the course may include mechanics, electrical and motor controls, pneumatics, computer basics, and programmable logic controllers.
Group 4	21053A001	Emerging Technologies	Emerging Technologies courses emphasize students' exposure to and understanding of new and emerging technologies. The range of technological issues varies widely but typically include lasers, fiber optics, electronics, robotics, computer technologies (software engineering), Game Art and Design, CAD/CAM, communication modalities, and transportation technologies.
Group 4	21054A004	Technology, Society, and Sustainability	Technology, Society and Sustainability course will provide an overview of the importance of, impact on, and relationships between technological endeavors and society at large. This courses typically emphasize environmental factors, economics impacts and the influences of society on technological/environmental endeavors.
Group 4	21013A001	Aerospace Engineering	Aerospace Engineering courses introduce students to the world of aeronautics, flight, and engineering. Topics covered in the course may include the history of flight, aerodynamics and aerodynamics testing, flight systems, astronautics, space life systems, aerospace materials, and systems engineering.
Group 4	21012A001	Civil Engineering and Architecture	Civil Engineering and Architecture courses provide students with an overview of the fields of Civil Engineering and Architecture while emphasizing the interrelationship of both fields. Students typically use software to address real world problems and to communicate the solutions that they develop. Course topics typically include the roles of civil engineers and architects, project-planning, site-planning, building design, project documentation, and presentation.
Group 4	21061A001	Wind Turbine Maintenance	Wind Turbine Maintenance courses provide students with an understanding of wind turbine maintenance and operation and the wind energy industry. These course enable students to study site preparation and construction, turbine component specifications and manufacturing, operation and maintenance programs, and data acquisition and assessment.
Group 4	17104A002	Industrial Electronics II	This course provides planned learning activities designed to allow students to gain knowledge and skills in testing, maintaining, and repairing electronic equipment and systems used in the manufacturing industry. Learning activities in this course emphasizes the development of more advanced knowledge and skills than those provided in Industrial Electronics I. Skills introduced in this course include instruction in the interpretation of technical sketches, schematics, and circuit diagrams . Additional units of instruction include the identification and causes of equipment malfunctions, the repair and replacement of parts and equipment, the care and use of standard tools, equipment, and specialized instrumentation testing devices
Group 4	18506A001	Alternative Energy	Alternative Energy courses help students identify renewable and nonrenewable energy sources and natural resources. Topics typically include alternative energy sources and their respective advantages and disadvantages; the impact of conventional and alternative energy sources on the environment; the efficiency of energy production from various sources; and careers in the fields of alternative energy and sustainability.
Group 4	13302A002	Industrial Maintenance II	This course builds on the skills and concepts introduced in Industrial Maintenance I. This course provides planned learning experiences and activities in safety, advanced mathematics, precision measurement, and blueprint reading. The program also includes instruction in preventative maintenance, automated control systems, automated manufacturing, hydraulic /pneumatic equipment, metal lathe operations, drill press and metal sawing operations, rotating equipment, pipe fitting, and insulation.

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Group 4	13102A001	Mechatronics	Electro-Mechanical Systems courses provide students with instruction and experience in components and equipment that use electricity and the power of physical forces. Students gain an understanding of the principles of electricity and mechanics and their application to gears, including hydraulic/pneumatic equipment, cams, levers, circuits, and other devices used in the manufacturing process or within manufactured goods.
Group 4	13203A002	Machine Tool Technology/ Machinist II	This course provides more in-depth skill development in various types of precision tool operation, especially using mills, lathes, and surface grinders to perform machining tasks. Power cutoff saws and power band saws are also covered. Students also explore the use of computer and numerical controlled machining.
Group 4	13203A006	Machine Shop Technology II	This course builds on the skills and concepts introduced in Machine Shop Technology I. Additional skill -building activities include automated manufacturing, the use of end mills, surface grinders, drill presses, and basic welding procedures.
Group 4	13055A002	Precision Metal Production II	This course is a continuation of Precision Metal Production I and builds on the skills introduced in that course. This course begins to offer students the opportunity to specialize in specific areas of manufacturing such as machine tool set -up and operation, welding, quality control, automated machine set-up and operation, and sheet metal fabrication. Course content includes the following areas: metallurgy and heat treatment of metal, advanced machine set -up and operation, numerical control/computer, numerical control machining, performing supervisory functions and installation, and maintenance and repair of machinery.
Group 4	13205A002	Sheet Metal Technology II	This course is a continuation of and builds on the skills and concepts introduced in Sheet Metal Technology I. In this course students are introduced to precision measurement, power assisted sheet metal forming equipment, constructing ductwork, hand and power tools specifically designed for sheet metal fabrication, sheet metal production equipment, and advanced welding and brazing.
Group 4	13207A002	Welding Technology II	This course builds on the skills and concepts introduced in Welding Technology I and provides more in -depth skill development in various types of welding including horizontal, vertical, overhead, and circular techniques. Students also explore the use of robotic and automated production welding.
Group 4	17007A002	Cabinetmaking & Millwork II	This course provides learning experiences related to the erection, installation, and maintenance of commercial and residential cabinetry, and the repair and maintenance of stationary woodworking machinery. Planned learning activities emphasize the development of more advanced knowledge and skills than those provided in Cabinetmaking and Millwork I. This course provides the student with the knowledge and skills necessary to perform basic cabinetry construction and how it relates to the manufacturing process. In addition, more advanced woodworking machine maintenance skills are introduced.
Group 5	21998A001	STEM Workplace Experience	Science, Technology, Engineering & Mathematics Workplace Experience courses provide work experience in fields related to the Science, Technology, Engineering & Mathematics cluster. Goals must be set cooperatively by the student, teacher, and employer (although students are not necessarily paid). These courses must include classroom instruction at least once per week, involving further study of the field, discussion of relevant topics that are responsive to the workplace experience and employability skill development. Workplace Experience courses must be taught by an approved WBL educator-coordinator. These courses should be aligned to a Career Development Experience that could include: Student-led Enterprises; School-based Enterprises; Immersion Supervised Agricultural Experiences; Clinical Experiences in Health Science and Technology programs; Internships; and Apprenticeship programs including Youth Apprenticeships, Pre-apprenticeships, and Registered Apprenticeships.

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Group 5	21098A002	Energy Workplace Experience	Energy Workplace Experience courses provide work experience in fields related to the Energy cluster. Goals must be set cooperatively by the student, teacher, and employer (although students are not necessarily paid). These courses must include classroom instruction at least once per week, involving further study of the field, discussion of relevant topics that are responsive to the workplace experience and employability skill development. Workplace Experience courses must be taught by an approved WBL educator-coordinator. These courses should be aligned to a Career Development Experience that could include: Student-led Enterprises; School-based Enterprises; Immersion Supervised Agricultural Experiences; Clinical Experiences in Health Science and Technology programs; Internships; and Apprenticeship programs including Youth Apprenticeships, Pre-apprenticeships, and Registered Apprenticeships.
Group 5	13998A002	Manufacturing Workplace Experience	Manufacturing Workplace Experience courses provide work experience in fields related to the Manufacturing cluster. Goals must be set cooperatively by the student, teacher, and employer (although students are not necessarily paid). These courses must include classroom instruction at least once per week, involving further study of the field, discussion of relevant topics that are responsive to the workplace experience and employability skill development. Workplace Experience courses must be taught by an approved WBL educator-coordinator. These courses should be aligned to a Career Development Experience that could include: Student-led Enterprises; School-based Enterprises; Immersion Supervised Agricultural Experiences; Clinical Experiences in Health Science and Technology programs; Internships; and Apprenticeship programs including Youth Apprenticeships, Pre-apprenticeships, and Registered Apprenticeships.
Group 5	21048A001	Engineering Workplace Experience	Engineering Workplace Experience courses provide students with work experience in an engineering-related field. Goals must be set cooperatively by the student, teacher, and employer (although students are not necessarily paid). These courses must include classroom instruction at least once per week, involving further study of the field, discussion of relevant topics that are responsive to the workplace experience and employability skill development. Workplace Experience courses must be taught by an approved WBL educator-coordinator. These courses should be aligned to a Career Development Experience that could include: Student-led Enterprises; School-based Enterprises; Immersion Supervised Agricultural Experiences; Clinical Experiences in Health Science and Technology programs; Internships; and Apprenticeship programs including Youth Apprenticeships, Pre-apprenticeships, and Registered Apprenticeships.
Group 5	21098A001	Energy Systems Technology Workplace Experience	Energy Systems Technology Workplace Experience courses provide students with work experience in a field related to technological systems and structures. Goals must be set cooperatively by the student, teacher, and employer (although students are not necessarily paid). These courses must include classroom instruction at least once per week, involving further study of the field, discussion of relevant topics that are responsive to the workplace experience and employability skill development. Workplace Experience courses must be taught by an approved WBL educator-coordinator. These courses should be aligned to a Career Development Experience that could include: Student-led Enterprises; School-based Enterprises; Immersion Supervised Agricultural Experiences; Clinical Experiences in Health Science and Technology programs; Internships; and Apprenticeship programs including Youth Apprenticeships, Pre-apprenticeships, and Registered Apprenticeships.
Group 5	13998A001	Industrial Electronics Workplace Experience	Industrial Electronics Workplace Experience courses provide students with work experience in fields involving manufacturing, supported by classroom attendance and discussion. Goals must be set cooperatively by the student, teacher, and employer (although students are not necessarily paid). These

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			<p>courses must include classroom instruction at least once per week, involving further study of the field, discussion of relevant topics that are responsive to the workplace experience and employability skill development. Workplace Experience courses must be taught by an approved WBL educator-coordinator. These courses should be aligned to a Career Development Experience that could include: Student-led Enterprises; School-based Enterprises; Immersion Supervised Agricultural Experiences; Clinical Experiences in Health Science and Technology programs; Internships; and Apprenticeship programs including Youth Apprenticeships, Pre-apprenticeships, and Registered Apprenticeships.</p>
Group 5	13148A001	Machine Tool Technology Workplace Experience	<p>Machine Tool Technology Workplace Experience courses provide students with work experience in fields related to manufacturing systems and/or research. Goals must be set cooperatively by the student, teacher, and employer (although students are not necessarily paid). These courses must include classroom instruction at least once per week, involving further study of the field, discussion of relevant topics that are responsive to the workplace experience and employability skill development. Workplace Experience courses must be taught by an approved WBL educator-coordinator. These courses should be aligned to a Career Development Experience that could include: Student-led Enterprises; School-based Enterprises; Immersion Supervised Agricultural Experiences; Clinical Experiences in Health Science and Technology programs; Internships; and Apprenticeship programs including Youth Apprenticeships, Pre-apprenticeships, and Registered Apprenticeships.</p>
Group 5	13248A001	Sheet-working Workplace Experience	<p>Sheet-working Workplace Experience courses provide students with work experience in the welding, machine technologies, or metalwork fields. Goals must be set cooperatively by the student, teacher, and employer (although students are not necessarily paid). These courses must include classroom instruction at least once per week, involving further study of the field, discussion of relevant topics that are responsive to the workplace experience and employability skill development. Workplace Experience courses must be taught by an approved WBL educator-coordinator. These courses should be aligned to a Career Development Experience that could include: Student-led Enterprises; School-based Enterprises; Immersion Supervised Agricultural Experiences; Clinical Experiences in Health Science and Technology programs; Internships; and Apprenticeship programs including Youth Apprenticeships, Pre-apprenticeships, and Registered Apprenticeships.</p>
Group 5	13248A002	Welding Workplace Experience	<p>Welding Workplace Experience courses provide students with work experience in the welding, machine technologies, or metalwork fields. Goals must be set cooperatively by the student, teacher, and employer (although students are not necessarily paid). These courses must include classroom instruction at least once per week, involving further study of the field, discussion of relevant topics that are responsive to the workplace experience and employability skill development. Workplace Experience courses must be taught by an approved WBL educator-coordinator. These courses should be aligned to a Career Development Experience that could include: Student-led Enterprises; School-based Enterprises; Immersion Supervised Agricultural Experiences; Clinical Experiences in Health Science and Technology programs; Internships; and Apprenticeship programs including Youth Apprenticeships, Pre-apprenticeships, and Registered Apprenticeships.</p>
Group 5	13098A001	Cabinetmaking Workplace Experience	<p>Cabinetmaking Workplace Experience courses provide students with work experience in fields related to manufacturing processing and production. Goals must be set cooperatively by the student, teacher, and employer (although students are not necessarily paid). These courses must include classroom instruction at least once per week, involving further study of the field, discussion of relevant topics that are responsive to</p>

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			<p>the workplace experience and employability skill development. Workplace Experience courses must be taught by an approved WBL educator-coordinator. These courses should be aligned to a Career Development Experience that could include: Student-led Enterprises; School-based Enterprises; Immersion Supervised Agricultural Experiences; Clinical Experiences in Health Science and Technology programs; Internships; and Apprenticeship programs including Youth Apprenticeships, Pre-apprenticeships, and Registered Apprenticeships.</p>
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