

ENGINEERING MANUFACTURING TECHNOLOGY CLUSTER

Project Lead The Way: A Pre-Engineering Program

PLTW's Pathway to Engineering (PTE) is designed to encompass all four years of high school. Courses are centered on activities that are hands-on and project-based. Students develop critical thinking and problem solving skills while using the same industry-leading 3D design software used by companies like Intel, Lockheed Martin, and Pixar.

They explore aerodynamics, manufacturing, and alternative energy, and apply biological and engineering concepts related to biomechanics – think robotics. Students design, test, and actually construct circuits and devices such as smartphones and tablets. They work collaboratively on a culminating capstone project.

Project Lead The Way courses have dual credit options with several universities across the country. See a PLTW instructor or go to: www.pltw.org for complete information.

T55071 PLTW: Introduction to Engineering Design (4802) **Open to grades 9, 10, 11, 12** **2 semesters, 1 credit per semester** **Approximate cost per semester: TBD** **Meets requirements: THD, AHD, Core 40** **Recommendation(s): Algebra** **Dual Credit Available**

This is an introductory course which develops student problem solving skills using the design process. Students document their progress of solutions as they move through the design process. Students develop solutions using elements of design and manufacturability concepts. They develop hand sketches using 2D and 3D drawing techniques. Computer Aided Design (CAD).

T55081 PLTW: Principles of Engineering (5644) **Open to grades 10, 11, 12** **2 semesters, 1 credit per semester** **Approximate cost per semester: TBD** **Meets requirements: THD, AHD, Core 40** **Recommendation(s): Introduction to Engineering Design or Instructor Approval, Algebra I and Geometry** **Dual Credit Available**

Note: Qualifies for Quantitative Reasoning

This course focuses on the process of applying engineering, technological, scientific and mathematical principles in the design, production, and operation of products, structures, and systems. It is designed to provide students interested in engineering careers to explore experiences related to specialized fields such as civil, mechanical, and materials engineering. Students will engage in research, development, planning, design, production, and project management to simulate a career in engineering. The topics of ethics and the impacts of engineering decisions are also addressed. Classroom activities are organized to allow students to work in teams and use modern technological processes, computers, CAD software, and production systems in developing and presenting solutions to engineering problems.

T55051 PLTW: Computer Integrated Manufacturing (5534) **Open to grades 11, 12** **2 semesters, 1 credit per semester** **Approximate cost per semester: TBD** **Meets requirements: THD, AHD, Core 40** **Recommendation(s): Introduction to Engineering Design, Principles of Engineering** **Dual Credit Available**

Note: Qualifies for Quantitative Reasoning

This course applies principles of rapid prototyping, robotics, and automation. This course builds upon the computer solid modeling skills developed in Introduction of Engineering Design. Students will use computer controlled rapid prototyping and CNC equipment to solve problems by constructing actual models of their three-dimensional designs. Students will also be introduced to the fundamentals of robotics and how this equipment is used in an automated manufacturing environment. Students will evaluate their design solutions using various techniques of analysis and make appropriate modifications before producing their prototypes.

T55061 PLTW: Digital Electronics (5538)

Open to grades 11, 12
2 semesters, 1 credit per semester
Approximate cost per semester: TBD
Meets requirements: THD, AHD, Core 40
Recommendation(s): Introduction to Engineering Design, Principles of Engineering
Dual Credit Available

Note: Qualifies for Quantitative Reasoning

This is a course of study in applied digital logic that encompasses the design and application of electronic circuits and devices found in video games, watches, calculators, digital cameras, and thousands of other devices. Instruction includes the application of engineering and scientific principles as well as the use of Boolean algebra to solve design problems. Using computer software that reflects current industry standards, activities should provide opportunities for students to design, construct, test, and analyze simple and complex digital circuitry software will be used to develop and evaluate the product design. This course engages students in critical thinking and problem-solving skills, time management

and teamwork skills.

T55501 Introduction to Industrial Technology (4800)

Open to grades 9, 10, 11, 12
2 semesters, 1 credit hour per semester
Approximate cost per semester: TBD
Meets requirements of: THD, AHD, Core 40

This course specializes in using modern technological processes, computers, design, and production systems in the production of products and structures through the use of automated production systems. Emphasis is placed on using modern technologies and on developing career-related skills for electronics, manufacturing, precision machining, welding, and architecture career pathways. Students apply ingenuity using tools, materials, processes, and resources to create solutions applied in electronics, manufacturing, precision machining, welding, and architecture. Course content should address major technological content related to topics such as architectural drawing and print design, design documentation using CAD systems, assignments involving the interface of CAD, CNC, CAM, and CIM technologies, computer simulation of products and systems, publishing of various media, animation and related multimedia applications, 3-D modeling of products or structures, digital creating and editing of graphics and audio files, control technologies, and automation in the modern workplace.

T55511 Introduction to Manufacturing (4784)

Open to grades 9, 10, 11, 12
2 semesters, 1 credit per semester
Approximate cost per semester: TBD
Meets requirements of: THD, AHD, Core 40

This course specializes in how people use modern manufacturing systems with an introduction to manufacturing technology

and its relationship to society, individuals, and the environment. An understanding of manufacturing provides a background toward developing engineering & technological literacy, developed through the study of the two major technologies, material processing and management technology, used by all manufacturing enterprises. Students will apply the skills and knowledge of using modern manufacturing processes to obtain resources and change them into industrial materials, industrial products and consumer products. Students will investigate the properties of engineered materials such as metallics, polymers, ceramics, and composites. After gaining a working knowledge of these materials, students will study six major types of material processes: casting and molding, forming, separating, conditioning, finishing, and assembling.

T55111 Mechanical Drafting CAD/CAM (4836)

Open to grades 10, 11, 12

2 semesters, 1 credit hour per semester

Approximate cost per semester: TBD

Recommendation(s): Intro to Engineering Design, OR Precision Machining II, OR Computer Integrated Manufacturing, OR Intro to Industrial Technology, OR Intro to Manufacturing

This course provides students with a basic understanding of the skills commonly used by engineers to design and prototype parts. Areas of study include: computer-aided drafting, three dimensional modeling, working drawings, machine tool programming, and machine tool set-up. Students will gain valuable hands-on experience with CAD/CAM software and a variety of automated machine tools. They will be expected to complete several projects (increasing in difficulty) relating to product design and development, automated programming, and operation of machine tools. Mechanical Drafting CAD/CAM is a project-based, hands-on introduction for students interested in advanced manufacturing careers.

T55612 Industrial Automation & Robotics I (5610)

Open to grades 10, 11, 12

2 semesters, 2 credit per semester

Approximate cost per semester: TBD

Meets requirements: THD, AHD, Core 40

Recommendation(s): Introduction to Manufacturing, Computers in Design and Production, PLTW Introduction to Engineering Design

Dual Credit Available

Industrial Automation & Robotics I will be a two-hour course that introduces students to curriculum covering the multi-craft skills needed by industrial technicians to complete the complex and varied tasks for the career. The year one curriculum will include OSHA 10 safety certification; basic electricity including electrical laws and principles of DC and AC currents; the basic theory, operation and programming of automated manufacturing systems; the basic principles and practices of mechanical technology; the common types of electrical wiring circuits used for power and control of electrical devices and motors used in manufacturing; and the common types of electrical wiring circuits used for power and control of electrical devices and motors used in advanced manufacturing. The year one curriculum will include General Industry: OSHA 10 safety certification.

T55622 Industrial Automation and Robotics II (5612)

Open to grades 11, 12

2 semesters, 2 credits per semester

Approximate cost per semester: TBD

Meets requirements of: THD, AHD, Core 40

Recommendation(s): Introduction to Manufacturing, Introduction to Industrial Technology, PLTW Introduction to Engineering Design

Required Prerequisite: Industrial Automation and Robotics I

Dual Credit Available

Note: Qualifies for Quantitative Reasoning

Industrial Automation and Robotics II includes the study of industrial robots, programming PLC's, automating cells, advanced programming and designing/building task oriented robots. Students will engage in active learning, critical thinking and problem solving through advanced robotic procedures and processes. Students will learn industrial robotic programming languages, strategies for automating to improve efficiencies and be introduced to advanced programming language that is common in global industry. Students will study basic computer numerical controlled (CNC) machining and will combine automation and CNC machining. They will apply information in real world situations to create working solutions and will complete projects, including building robots to perform tasks in autonomous mode and analyze their own career pathway in this sector.

T55212 Electronics and Computer Technology I (5684)

Open to grades 10, 11, 12

2 semesters, 2 credits per semester

Approximate cost per semester: TBD

Meets requirements of: THD, AHD, Core 40

Recommendation(s): (IT) Information Communications and Technology, Computers in Design and Production, PLTW Introduction to Engineering Design

Dual Credit Available

This course introduces students to the fundamental electronic concepts necessary for entry into an electronic and computer systems career pathway, which will culminate with industry certifications or additional post-secondary education. Classroom and laboratory experiences will allow students to begin their career preparation in the fundamental electronics concepts of Jobsite Skills, DC Basics, AC Basics, and Personal Computer Design, and will incorporate safety, technical writing, mathematical concepts, and customer service.

T55222 Electronics and Computer Technology II (5694)

Open to grades 11, 12

2 semesters, 2 credits per semester

Approximate cost per semester: TBD

Meets requirements: THD, AHD, Core 40

Prerequisite(s): Electronics & Computer Technology I

Dual Credit Available

Note: Qualifies for Quantitative Reasoning.

This course provides opportunity for students to continue with foundational electronic concepts including circuit analysis and digital electronics modules. After completing the two additional foundational modules, student may choose to focus on one of the optional modules including more intense instruction, research, specialized projects, and internships. The optional modules include industrial technology, emerging electronic technologies, residential and commercial electronic communication, and automation. Classroom, laboratory, and work-based experiences in the fundamental electronics concepts of circuit analysis and digital electronics as well as one of the optional modules incorporate safety, technical writing, mathematics, and customer service.

T55232 Electronics and Computer Technology III (5694)

Open to grade 12

2 semesters, 2 credits per semester

Approximate cost per semester: TBD

Meets requirements: THD, AHD, Core 40

Prerequisite(s): Electronics & Computer Technology II with a C or better

Upon successful completion of the first two years of Electronics Technology, students may be eligible for this course, involving laboratory activities in advanced digital circuitry, microprocessors, personal computer troubleshooting and repair, and programmable controller applications. Emphasis is on the design, circuit analysis, and troubleshooting of these circuits. Opportunities for leadership skills, exposure

to working in a team based work system and applications of technology will be given through participation with Skills USA. Qualified students may be eligible to participate in a School-To-Work placement.

T55312 Precision Machining I (5782)

Open to grades 10, 11, 12
2 semesters, 2 credits per semester
Approximate cost per semester: TBD
Meets requirements: THD, AHD, Core 40
Recommendation(s): Introduction to Industrial Technology, Introduction to Manufacturing
Dual Credit Available

Note: Qualifies as a Quantitative Reasoning course for the General diploma only.

This course provides students with a basic understanding of the precision machining processes used in industry, manufacturing, maintenance, and repair. The course instructs the student in industrial safety, terminology, tools and machine tools, measurement and layout. Students will become familiar with the setup and operation of power saws, drill presses, lathes, milling machines, grinders, and an introduction to CNC machines.

T55322 Precision Machining II (5784)

Open to grades 11, 12
2 semesters, 2 credits per semester
Approximate cost per semester: TBD
Meets requirements: THD, AHD, Core 40
Prerequisite(s): Precision Machining I
Dual Credit Available

Note: Qualifies for Quantitative Reasoning

This course is a more in-depth study of skills learned in Precision Machining I with a stronger focus in CNC setup, operation, and programming. Classroom activities concentrate on precision set-up and inspection work as well as machine shop calculations. Students develop skills in advanced machining and measuring parts

involving tighter tolerances and more complex geometry. A continued focus on safety is also included.

T55332 Precision Machining III (5784)

Open to grade 12
2 semesters, 2 credits per semester
Approximate cost per semester: TBD
Meets requirements: THD, AHD, Core 40
Prerequisite(s): Precision Machining II with a C or better

Upon successful completion of the first two years of Precision Machining, students may be eligible to participate in a course where the student studies advanced lathe work, milling operations, surface grinding, and computerized numerical control milling. Precision measurement, advanced blueprint reading, and industrial math are also taught. CNC programming and operating are taught first, second, and third year. Job opportunities in machine trades are tremendous. Qualified students are eligible for a school-to-work placement in the community.

T55412 Welding Technology I (5776)

Open to grades 10, 11, 12
2 semesters, 2 credits per semester
Approximate cost per semester: TBD
Meets requirements: THD, AHD, Core 40
Recommendation(s): Introduction to Industrial Technology, Introduction to Manufacturing
Dual Credit Available

This course includes classroom and laboratory experiences that develop a variety of skills in oxy-fuel cutting and Shielded Metal Arc welding (SMAW). This course is designed for individuals who intend to make a career as a Welder, Technician, Sales, Designer, Researcher, or Engineer. Emphasis is placed on safety at all times. OSHA standards and guidelines endorsed by the American Welding Society (AWS) are used. Instructional activities emphasize properties of metals, safety issues, blueprint reading, electrical

principles, welding symbols, and mechanical drawing through projects and exercises that teach students how to weld and to be prepared for college and career success.

T55422 Welding Technology II (5778)

Open to grades 11, 12

2 semesters, 2 credits per semester

Approximate cost per semester: TBD

Meets requirements: THD, AHD, Core 40

Prerequisite(s): Welding Technology I

Dual Credit Available

Welding Technology II builds on the gas metal arc welding (GMAW), flux-cored arc welding (FCAW), gas tungsten arc welding (GTAW), plasma cutting, and carbon arc skills covered in Welding Technology I. Emphasis is placed on safety at all times. OSHA standards and guidelines endorsed by the American Welding Society (AWS) are used. Instructional activities emphasize properties of metals, safety issues, blueprint reading, electrical principles, welding symbols, and mechanical drawing through projects and exercises that teach students how to weld and be prepared for college and career success.

T55432 Welding Technology III (5778)

Open to grade 12

2 semesters, 2 credits per semester

Approximate cost per semester: TBD

Meets requirements: THD, AHD, Core 40

Prerequisite(s): Welding Technology II with a C or better.

Upon successful completion of the first two years of welding, students may be eligible to participate in a course where the student will be prepared for Advanced Placement and/or advanced welding techniques. Lab activities are patterned after a project-oriented job shop and students will be graded on the quality of projects that they get done and/or their Advanced Placement evaluations. As advanced students, they will be overseeing younger students and learning management skills and team building efforts. At the end of the third year of welding, an AWS welding certification is offered at the student's expense. This certificate can be used to fulfill requirements for a Technical Honors Diploma.