

ENGINEERING, MANUFACTURING, AND TECHNOLOGY

171600 Introduction to Construction (2-hour class, yearlong)

Grade(s): 9-12 Credit: 1.0 block course Term(s): 1 & 2

CTE

Building Repair & Maintenance courses provide students with knowledge and skills related to devices and systems found in the home. Course content may include electrical wiring, plumbing, window and door repair and installation, wall and floor repair and finishing, furniture repair and finishing, and small appliance repair and installation, wall and floor repair and finishing, furniture repair and finishing, and small appliance repair.

172310 Woodworking

Grade(s): 10-12 Credit: .5 per semester Term(s): 1 or 2

CTE

This course involves the use of hand, power, and mounted machine tools in a woodshop setting. Students will explore pathways to working with wood either as a hobby or vocation. Students will learn about different types of wood, lumber, boards, and forestry products. They will practice fine woodworking skills and learn how to produce items ranging from entry level to finished furniture.

171621-171622 Construction Trades 1* (2-hour class, yearlong)

Grade(s): 10-12 Credit: 1 per semester Term(s): 1 & 2

CTE, ACC

This introductory course provides students a "hands-on" experience in various construction occupations to include carpentry, electrical, plumbing, heating, sheetrocking, and taping, painting, and cabinet installation. Most learning will take place on an actual construction site in the community building homes and/or working on rehabilitation projects for nonprofit organizations. Students will increase math abilities related to the trade and construct residential dwellings to meet codes while interpreting blueprints.

**This course is offered at East High School. Denfeld High School students may register for this course. Transportation is provided to and from East.*

171721-171722 Construction Trades 2* (2-hour class)

Prerequisite: Construction Trades 1

Grade(s): 10-12 Credit: 1 per semester Term(s): 1 & 2

CTE, ACC

Construction Technology 2 provides students with advanced skills, tools, and knowledge in current home construction techniques. Students will build a home and/or work on rehabilitation projects for nonprofit organizations. In addition, students will increase their skill levels in all trades and understand mathematical applications as applied to estimating materials so work on projects can progress in an orderly and coordinated schedule. Most learning will take place on a job-site located within the community. Students may participate in an optional youth apprenticeship/internship with a trade organization, if selected.

**This course is offered at East High School. Denfeld High School students may register for this course. Transportation is provided to and from East.*

171921-171922 Automotive Basics: Brakes and Engines (2-hour class, yearlong)

Grade(s): 10-12 Credit: 1 per semester Term(s): 1 & 2

CTE, ACC

This course introduces students to basic automotive technology including the maintenance and light repair of vehicles with a focus on brakes and engines. Students will earn SP2 shop safety certification. Students will learn to perform engine diagnostics as well as disc, drum, and ABS brake services and repairs. Students will utilize service information and testing equipment to diagnose problems and perform repairs. The instruction will also focus on employability skills, ethics training, and the technical career exploration necessary for entry level employment or post-secondary education in a technical field.

This is a year-long 2-hour (2 credit) course with no prerequisites. Courses Brakes and Engines and Transmissions and Suspensions may be taken in any order. The program is accredited by the ASE (Automotive Service Excellence) Education Foundation.

**This course is offered at Denfeld High School. East High School students may register for this course. Transportation is provided to and from Denfeld.*

172121-172122 Automotive Basics: Transmissions and Suspension (2-hour class, yearlong)

Grade(s): 10-12 Credit: 1 per semester Term(s): 1 & 2

CTE, ACC

This course introduces students to basic automotive technology including the maintenance and light repair of vehicles with a focus on transmissions and suspensions. Students will earn SP2 shop safety certification. Students will perform the following: wheel and tire maintenance, power steering system service and inspections, front and rear suspension

inspection, maintenance, and repair, and automatic and manual transmission service and adjustments. Students will utilize service information and testing equipment to diagnose problems and perform repairs. The instruction will also focus on employability skills, ethics training, and the technical career exploration necessary for entry level employment or post-secondary education in a technical field.

This is a yearlong 2-hour (2 credit) course with no prerequisites. Brakes and Engines and Transmissions and Suspension may be taken in any order. The program is accredited by the ASE (Automotive Service Excellence) Education Foundation.

**This course is offered at Denfeld High School. East High School students may register for this course. Transportation is provided to and from Denfeld.*

172231-172232 Advanced Automotive (Block class, yearlong)

Prerequisite: Automotive Basics: Brakes and Engines Automotive Basics: Transmission and Suspension

Grade(s): 10-12 **Credit:** 1 per semester **Term(s):** 1 & 2

CTE, ACC

Experienced students will work at an advanced level in the automotive shop using test equipment and doing live on car diagnostic and repair work on electrical and electronic systems including HVAC systems and engine performance testing. Students will demonstrate the proper use of a digital volt meter and OBDII scan tools. The instruction will also focus on employability skills, ethics training, and the technical career exploration necessary for entry level employment or post-secondary education in a technical field. Students are encouraged to participate in job shadowing and/or an internship at a local repair facility.

This is a yearlong 2-hour (2 credit) course for students with prerequisites. The program is accredited by the ASE (Automotive Service Excellence) Education Foundation.

**This course is offered at Denfeld High School. East High School students may register for this course. Transportation is provided to and from Denfeld.*

121502 Principles of Engineering

Prerequisite: Introduction to Engineering Design

Grade(s): 9-12 **Credit:** .5 per semester **Term(s):** 2

CTE

Opportunity to earn the Certified SolidWorks Associate (CSWA) certification.

Principles of Engineering Design builds off the skills learned in Introduction to Engineering Design. Students continue to develop their understanding of engineering concepts and proficiency using SolidWorks state-of-the-art Computer Aided Drafting (CAD) software. They learn to create assemblies, to read and prepare drawings found in manufacturing and engineering industries, and begin to explore more advanced CAD techniques like stress analysis and motion studies. This course fulfills the prerequisite for advancement in the Engineering Design sequence as well as the Fab Lab courses. It is recommended for any students interested in pursuing a career in engineering, design, technical illustration, 3D printing, machining, or other technical fields.

121211 Introduction to Engineering Design (CAD)

Grade(s): 9-12 **Credit:** .5 per semester **Term(s):** 1 or 2

CTE, ACC

Opportunity to earn the Certified SolidWorks Associate (CSWA) certification.

This course is a single semester introduction to engineering design concepts for students who would like to explore the Engineering Design program without the need to commit to a full year course. It also affords students who may not be able to fit a full-year course into their schedule the ability to get started on the Engineering Design pathway. Students learn about the engineering design process and parametric 3D modeling through the use of SolidWorks industry leading Computer Aided Drafting (CAD) software. Students who complete this course can continue on to Principles of Engineering to complete the prerequisite for advancement in the Engineering Design sequence as well as the Fab Lab courses. It is recommended for any students interested in exploring the engineering profession or who plan to pursue a career in engineering, design, technical illustration, 3D printing, machining, or other technical fields.

125000 Advanced Independent Engineering Research and Design

Prerequisite: Teacher Approval

Grade(s): 11-12 **Credit:** .5 per semester **Term(s):** 1 or 2

CTE, ACC

This course is the capstone program of the Engineering Design pathway. Students who have successfully completed beginning and intermediate coursework in the Engineering Design program are eligible for this course. Students will work under the premise of "engineer almost anything". Students will work to develop, research, and create projects in engineering and design fields. From this research, students will develop personalized projects to apply advanced skills in design and engineering concepts. This hands-on course will allow students to independently develop skills for future career pathways in STEM, Engineering and Design. Students will work closely with instructors on developing individual learning plans and standards.

122101 CAD for Architecture I

Grade(s): 9-12 **Credit:** .5 per semester **Term(s):** 1

CTE

This course is intended specifically for students interested in pursuing a career in an architectural field. Students are introduced to Revit Architectural design software where they learn to prepare various types of drawings found in the architectural drafting industry. Students learn about the composition of a typical structure while creating detailed working drawings and Building Information Models (BIM) for homes, duplexes, and cabins. This course is recommended for students interested in pursuing a career in architecture, real estate, interior decorating, or a building trade.

122102 CAD for Architecture II

Prerequisite: CAD for Architecture

Grade(s): 9-12 **Credit:** .5 per semester **Term(s):** 2

CTE

This course builds off the skills learned in CAD for Architecture I. Students continue to develop their understanding of architectural concepts and proficiency using Revit Architectural design software. Students tackle more complex projects, creating detailed working drawings and in-depth Building Information Models (BIM) to design larger structures like malls and office buildings. This course is recommended for students interested in pursuing a career in architecture, real estate, interior decorating, or a building trades.

122110 Advanced Independent Architecture Research and Design

Prerequisite: CAD for Architecture

Grade(s): 10-12 **Credit:** .5 per semester **Term(s):** 1 or 2

CTE

This course builds on professional skills learned in CAD for Architecture II. Students continue to develop their understanding of architectural concepts and proficiency using Revit Architectural design software. Students tackle more complex projects, focusing on detailed design prints. Students build a portfolio, with all their drawings for internships with local Architecture Firms. This course is recommended for students interested in pursuing a career in architecture, real estate, or commercial structural buildings.

121201 Fab Lab I

Prerequisite: Principles of Engineering Design and Manufacturing Technologies

Grade(s): 10-12 **Credit:** .5 per semester **Term(s):** 1 or 2

CTE

This course is the capstone program of the Engineering Design pathway. Students who have successfully completed beginning and intermediate coursework in the Engineering Design program are eligible for this course. Students will work under the premise of "engineer almost anything". Students will work to develop, research, and create projects in engineering and design fields. From this research, students will develop personalized projects to apply advanced skills in design and engineering concepts. This hands-on course will allow students to independently develop skills for future career pathways in STEM, Engineering and Design. Student will work closely with instructor on developing individual learning plan and standards.

121202 Fab Lab II

Prerequisite: Fab Lab I

Grade(s): 10-12 **Credit:** .5 per semester **Term(s):** 2

CTE

In Fab Lab II, students expand on what they learned in Fab Lab I. They continue to apply their knowledge of engineering, design, and manufacturing to take ideas through the engineering design process and into prototype products. This hands-on course is designed to let students explore software, machines, and practices used in engineering design and give them practical experience. Students work to solve engineering problems through design and development of a prototype, and then test their product and make any revisions to improve their design. Students will work both independently and in groups to create designs using CAD software and fabricate their prototype using the equipment available to them in the Fab Lab. A great deal of emphasis is placed on working as a team, problem solving, process iteration, design improvement, and creating things that interest you.

1172600 Robotics 1

Grade(s): 10-12 **Credit:** .5 per semester **Term(s):** 1 or 2

CTE

Robotics is a lab-based course that uses a hands-on approach to introduce the basic concepts of robotics, focusing on the construction and programming of autonomous and operator-controlled mobile robots. Students will learn how to use feedback from sensors and apply mathematics and measurement to program a robot to navigate in its environment. Students will have the opportunity to complete multiple challenges involving guided research, problem solving, and design documentation. The class will promote applications of engineering principles while exploring topics in design, programming, electrical wiring, pneumatics, and strategy. Emphasis will be placed on working as a team and project management. This course is a great introduction to robotics for students interested in joining a LeFIRST competition robotics team.

172610 Robotics 2

Prerequisites: Robotics 1

Grade(s): 10-12 **Credit:** .5 per semester **Term(s):** 2

CTE

Robotics 2 is a lab-based course that uses a hands-on approach to further the concepts of robotics learned in Robotics 1, with an additional focus of robotics programming and autonomous robotic control. Students will continue to build on their understanding of mechanical robotics concepts, but will also learn to add sensors so their robots can act independently based on external stimuli.

121301-121302 Advanced Engineering Design I and II (CAD III and CAD IV) **Prerequisite:** Principles of Engineering
Grade(s) 10-12 **Credit:** .5 per semester **Term(s):** 1 & 2 **CTE, ACC**

Opportunities for Career Development Internship

This course is the main continuation of the Engineering Design pathway for students who have completed one year of engineering design studies or have already passed the Certified SolidWorks Associate (CSWA) exam. Students continue to build on their knowledge of CAD and engineering design procedures. They explore advanced CAD techniques like lofts, sweeps, surfacing, cavity molds, structural members, multibody parts, and complex top-down assemblies. They learn to create proper engineering drawings, including exploded view assemblies, bill of materials, detailed views, callouts, datums, and tolerancing. Any students who have not yet earned their CSWA will work to obtain that certification early in the year. The course will include a reverse engineering project where students will thoroughly analyze an existing product and redesign it in CAD. Students will explore possible design improvements or revisions for their reverse engineering project, and take those ideas through the process of design, analysis and application. Throughout the year, the class will review preparation materials of all three segments of the Certified SolidWorks Professional (CSWP) exam.

124101 Manufacturing Technologies I

Grade(s): 9-12 **Credit:** .5 per semester **Term(s):** 1

CTE

In this course, students are introduced to the tools, materials, techniques, and skills that are found in manufacturing industries. Students will learn about the processes, procedures, and safety for taking raw materials into a finished manufactured product. Students learn to operate drill presses, table saws, miter saws, circular & belt sanders, grinders, planers, jointers, scroll saws, and band saws as well as many other hand tools. Students learn to etch designs into parts using the Epilog Helix Laser machine. Projects will focus on fabricating parts and products while working with metals, woods, and plastics. This course is one of the prerequisites for the Fab Lab pathway. It is recommended for students wishing to pursue a career in manufacturing, woodworking, design, construction, or building trades.

124102 Manufacturing Technologies II

Prerequisite: Manufacturing Technologies I

Grade(s): 9-12 **Credit:** .5 per semester **Term(s):** 2

CTE

In this course, students continue to explore techniques and skills found in the manufacturing industries that they started in Manufacturing Technologies I. Coursework will focus more heavily on precision machining as students learn to use a vertical mill. Students will work with a wide range of materials including wood, aluminum, steel, acrylic, HDPE, UHMW and other plastics. They will learn about the processes, procedures and safety for taking raw materials into finished manufactured products. This course is recommended for students wishing to pursue a career in manufacturing, machining, construction, or building trades.

124100 Advanced Manufacturing Technologies III

Prerequisite: Manufacturing Technologies II

Grade(s): 10-12 **Credit:** .5 per semester **Term(s):** 1 or 2

CTE

In this course, students continue and expand their study of the tools, materials, techniques, and skills that are found in the machine tool and manufacturing industry. Students will apply their skills and knowledge of processes and techniques to more complex projects. Students will learn the basics of welding as well as computer-controlled machine operation using processes in CAD, CAM, and CNC. Students will be expected to design, plan and complete a large-scale project. Emphasis is placed on individual design, creativity, safety, and craftsmanship. In this course, students will be expected to work independently while developing leadership skills. This course is recommended for students wishing to pursue a career in manufacturing, wood working, metal working, machining, construction, or building trades.

121610 Weldments

Prerequisite: Principles of Engineering

Grade(s): 10-12 **Credit:** .5 per semester **Term(s):** 1 or 2

CTE

Opportunity to earn the Certified SolidWorks Advanced Professional in Weldments (CSWAP-WD) certification.

In this course, students explore the SolidWorks Weldments functionality to design welded structures. They design models using 3D sketches and weldment profiles. They learn to modify corner treatments such as mitered corners and end-butts, make their designs structurally sound using support beams and gussets, and apply finishing features like end caps and base plates. They determine the types of weld beads to be used for joining parts as well as how to specify them on an engineering drawing. They also learn how to use SolidWorks Weldments to derive cut-lists for their design. This course may require students to complete some work independently.

121620 Simulation: Finite Element Analysis

Prerequisite: Principles of Engineering

Grade(s): 10-12 **Credit:** .5 per semester **Term(s):** 1 or 2

CTE

Opportunity to earn the Certified SolidWorks Associate in Finite Element Analysis (CSWA-FEA) certification.

In this course, students use SolidWorks Simulation to apply the Finite Element Method (FEM) to analyze engineering designs. They perform static analysis studies on parts to apply axial and shear forces to determine bending moments, displacements, reaction forces, strains, stresses, and factors of safety distribution. They examine the stress-strain curve for different materials, and how different loads and restraints affect deformation or displacement that can lead to a potential failure in a model. This course may require students to complete some work independently.