

For students interested in a career in science, technology, engineering, or architecture, the following series of courses would be of tremendous benefit. These technology courses provide opportunities to develop problem-solving skills that are essential in any creative process. In addition, industrial technology courses allow students to explore processes used to shape materials in a variety of personal projects. Students will also have opportunities to learn how to use computers to make engineering plans and drawings and to control automated manufacturing systems.

The Lakeville School District is unique in its ability to prepare students for several levels of technical occupations. It is possible to use experiences gained in Industrial Technology courses to go directly to work in a technical discipline after high school. IT courses also provide the background for students to successfully complete a technical college program and become skilled technicians. Industrial Technology course offerings also support four-year college programs in architecture, engineering, publishing, and construction management.

Industrial Technology provides center-based programs. This means some programs will be open to students at Lakeville North and Lakeville South High Schools but will be located in only one building. Building locations are indicated in the course descriptions.



## **Architecture 1**

Grades: 9 - 12

Instructional Delivery: Face-to-face

Prerequisite: None

Location: LNHS & LSHS

Semester-long course

At LNHS, this course fulfills the Arts or elective requirement for graduation for the Class of 2020, 2021, and 2022.

At LNHS, this course fulfills the elective requirement for graduation for the Class of 2023.

At LSHS, this course fulfills the Arts or elective course requirement for graduation.

Course Description: This course is the study of the basic concepts of residential design.

Primary units of study include basic house designs, the artistic process and foundations, primary considerations, architectural drafting fundamentals and room and space planning.

Students will demonstrate learning through projects using basic skills with industry standard AutoDesk computer-aided design software to create working drawings to include floor plans, elevation drawings, foundation plans, kitchen plans and construction details and design.

Course Recommendation: This course is recommended for students interested in careers related to architecture and building construction.

Board Approved Primary Resources:

Architecture: Residential Drafting and Design

Clois E Kicklighter - Joan C Kicklighter - Goodheart-Wilcox Co. – 2003 – Print  
ISBN: 9781590701959

Architecture: Residential Drafting and Design  
Clois E Kicklighter - Joan C Kicklighter - Goodheart-Wilcox Co. – 2008 – Print  
ISBN: 9781590706992

Basic Technical Drawing  
Henry Cecil Spencer - John T Dygdon - James E Novak - Glencoe/McGraw-Hill – 2004 – Print  
ISBN: 9780078457487

Additional Registration Information: Colleges and universities may or may not accept this course as an Arts credit.



## **Architecture 2**

Grades: 10 - 12

Instructional Delivery: Face-to-face

Prerequisite: Architecture 1

Location: LNHS & LSHS

Semester-long course

At LNHS, this course fulfills the Arts or elective requirement for graduation for the Class of 2020, 2021, and 2022.

At LNHS, this course fulfills the elective requirement for graduation for the Class of 2023.

At LSHS, this course fulfills the Arts or elective course requirement for graduation.

Course Description: This course is a continuation of the study of architectural design focusing on multi-story and multi-unit residential structures.

Primary units of study include CAD commands and functions, room and space planning, the artistic process and foundations, construction systems, presentation methods, specifications and estimating.

Students will demonstrate learning through developing design skills with AutoDesk Revit software, completing a set of working drawings to include multiple levels and/or multiple units, elevation drawings, site plans, foundation plans, sections and construction details of projects of their own choice.

Course Recommendation: This course is recommended for students interested in careers related to architecture and building construction.

Board Approved Primary Resources:

Architecture: Residential Drafting and Design

Clois E Kicklighter - Joan C Kicklighter - Goodheart-Wilcox Co. – 2003 – Print  
ISBN: 9781590701959

Architecture: Residential Drafting and Design

Clois E Kicklighter - Joan C Kicklighter - Goodheart-Wilcox Co. – 2008 – Print

ISBN: 9781590706992

Basic Technical Drawing

Henry Cecil Spencer - John T Dygdon - James E Novak - Glencoe/McGraw-Hill – 2004 – Print

ISBN: 9780078457487

Additional Registration Information: Colleges and universities may or may not accept this course as an Arts credit.



### **Architecture 3**

Grades: 10 - 12

Instructional Delivery: Face-to-face

Prerequisite: Architecture 2

Location: LNHS & LSHS

Semester-long course

This course fulfills the elective requirement for graduation.

Course Description: The course is a continuation of the study of architectural design with an introduction to commercial design.

The primary units of study include CAD commands and functions, room and space planning, construction systems, presentation methods, specifications and estimating as related to specific challenges.

Students will demonstrate learning with AutoDesk Academy software, analyzing an architectural design brief and working in teams to design a solution to the challenge, completing a set of working drawings to include multiple levels, elevation drawings, site plans, foundation plans and construction details and deliver a multimedia presentation to a panel of licensed architects for evaluation at the Minnesota Technology Challenge.

Course Recommendation: This course is recommended for students interested in careers related to architecture and building construction.

Board Approved Primary Resources:

Architecture: Residential Drafting and Design

Clois E Kicklighter - Joan C Kicklighter - Goodheart-Wilcox Co. – 2003 – Print

ISBN: 9781590701959

Architecture: Residential Drafting and Design

Clois E Kicklighter - Joan C Kicklighter - Goodheart-Wilcox Co. – 2008 – Print

ISBN: 9781590706992

Basic Technical Drawing

Henry Cecil Spencer - John T Dygdon - James E Novak - Glencoe/McGraw-Hill – 2004 – Print

ISBN: 9780078457487

Additional Registration Information: None



## **Building Construction/Applied Architecture**

Grades: 9-12

Instructional Delivery: Face-to-face

Prerequisite: None

Location: LSHS

Semester-long course

This course fulfills the Arts or elective requirement for graduation.

Course Description: This course is the study of residential construction and building trades.

Primary units of study include blueprint reading, architectural scale modeling and structural engineering concepts.

Students will demonstrate learning through blueprint reading worksheets and hands on activities building scale models and mock-ups. Students will design simple structures with architectural CAD software, read and create scale design drawing and models, demonstrate familiarity with residential framing techniques and terminology, demonstrate safe lab and tool use, explore construction materials and technologies and construct residential electrical circuits.

Course Recommendation: This course is recommended for students interested in careers related to architecture and building construction.

Board Approved Primary Resources:

Architecture: Residential Drafting and Design

Clois E Kicklighter - Joan C Kicklighter - Goodheart-Wilcox Co. – 2003 – Print

ISBN: 9781590701959

Architecture: Residential Drafting and Design

Clois E Kicklighter - Joan C Kicklighter - Goodheart-Wilcox Co. – 2008 – Print

ISBN: 9781590706992

Basic Technical Drawing

Henry Cecil Spencer - John T Dygdon - James E Novak - Glencoe/McGraw-Hill – 2004 – Print

ISBN: 9780078457487

Additional Registration Information: Students will have the opportunity to take the OSHA 10 training and certification test. This training provides an entry-level construction worker's general awareness on recognizing and preventing hazards on a construction site. A fee will be assessed for any projects taken home. Students may purchase higher quality materials than offered as part of the course. LNHS students provide their own transportation.



## **Electricity 1**

Grades: 9 - 12

Instructional Delivery: Face-to-face

Prerequisite: None

Location: LNHS and LSHS

Semester-long course

This course fulfills the elective requirement for graduation.

Course Description: This course is the study of AC and DC circuit theory that also includes an introduction to residential wiring.

The primary units of study include Ohm's law and power in series, parallel and series-parallel circuits, magnetism and electromagnetism, measurement and testing instruments, circuit construction, testing and troubleshooting, and wiring and troubleshooting a variety of typical residential circuits in a wall trainer.

The students will demonstrate learning through reading and interpreting electrical schematics to determine voltage, current and resistance, constructing and testing basic electrical circuits, constructing and troubleshooting electrical and electronic projects, wiring and troubleshooting typical residential circuits safely.

Course Recommendation: This entry-level course is recommended for students interested in careers related to electrical circuit design and repair, electrical engineering or residential and commercial electrician.

Board Approved Primary Resource:

Electricity and Electronics

Howard H Gerrish - William Dugger - Richard M Roberts - Goodheart-Wilcox Co. – 2003 – Print

ISBN: 9781590702079

Additional Registration Information: None



## **Electricity 2**

Grades: 9 - 12

Instructional Delivery: Face-to-face

Prerequisite: Electricity 1

Location: LNHS and LSHS

Semester-long course

This course fulfills the elective requirement for graduation.

Course Description: This course is the study of computer system maintenance and repair designed to meet the requirements for A Computer Repair certification.

The primary units of study include hardware, troubleshooting, maintenance and repair, operating systems and software, networking, security, and operational procedures.

Students will demonstrate learning while disassembling desktop computer systems to test and replace integrated components, while constructing and testing electronic and network cabling, and while troubleshooting and repairing computer systems and other electronic systems and devices.

Course Recommendation: This course is recommended for students interested in careers related to electrical circuit design and repair, electrical engineering or A Computer Repair certification.

Board Approved Primary Resource:

Computer Service and Repair

Richard M Roberts - Goodheart-Willcox – 2004 – Print

ISBN: 9781590703359

Additional Registration Information: None



## **Computer-Aided Design and Engineering 1**

Grades: 9 - 12

Prerequisite: None

Instructional Delivery: Face-to-face

Location: LNHS and LSHS

Semester-long course

This course fulfills the elective requirement for graduation.

Course Description: This course is the study of engineering through problem solving related to design. Computer-Aided Design (CAD) software provides the foundation for modeling team projects and individual solutions to design briefs.

The primary units of study include CAD commands and functions, applied geometry, international standards of representation, problem solving models and the engineering design process.

Students will demonstrate learning through the application of basic skills with Creo/Pro CAD software, read and create technical drawings and sketches, and apply design and problem-solving models while working individually and in teams to build functional models and mechanisms.

Course Recommendation: This course is recommended for students interested in careers related to science, technology and engineering.

Board Approved Primary Resources:

Basic Technical Drawing

Henry Cecil Spencer - John T Dygdon - James E Novak - Glencoe/McGraw-Hill – 2004 – Print

ISBN: 9780078457487

Mechanical Drawing: Board & CAD Techniques

Jay D Helsel - Glencoe/McGraw-Hill – 2003 – Print

ISBN: 9780078251009

Additional Registration Information: Demonstrations as well as student “hands on learning” will be provided regarding the design and manufacturing of product and or products.



## **Computer-Aided Design and Engineering 2**

Grades: 9 - 12

Instructional Delivery: Face-to-face

Prerequisite: Computer-Aided Design 1

Location: LNHS and LSHS

Semester-long course

This course fulfills the elective requirement for graduation.

Course Description: This course is the continuous study of engineering through problem solving related to design.

The primary units of study include CAD commands and functions, applied geometry, international standards of representation, problem solving models and the engineering design process, mechanisms and kinematics.

Students will demonstrate learning through projects with three dimensional computer-aided design (CAD) software, perform kinematic analysis of CAD models, create animations and renderings of designs, and continue to apply design and problem solving models while working individually and in teams to create structures and programmable remotely controlled mechanisms.

Course Recommendation: This course is recommended for students interested in careers related to science, technology and engineering.

Board Approved Primary Resources:

Basic Technical Drawing

Henry Cecil Spencer - John T Dygdon - James E Novak - Glencoe/McGraw-Hill – 2004 – Print

ISBN: 9780078457487

Mechanical Drawing: Board & CAD Techniques

Jay D Helsel - Glencoe/McGraw-Hill – 2003 – Print

ISBN: 9780078251009

Additional Registration Information: Demonstrations as well as student “hands on learning” will be provided regarding the design and manufacturing of product and or products.



## **Geometry Design and Engineering**

Grades: 9-10

Instructional Delivery: Face-to-face

Prerequisite: Intermediate Algebra

Location: LNHS

Year-long, two period course

This course fulfills the Math course requirement and Arts or elective course requirement for graduation.

Course Description: This course is the study of geometry concepts, such as analysis of plane, solid, and coordinate geometry, as they relate to design. Using geometric concepts, 3-D printers, laser cutters/etchers & CNC Benchtop Milling Machines students will create innovative prototypes and 3-D masterpieces.

The primary geometry units of study (congruence and similarity, properties of lines, triangles, quadrilaterals, circles, length, perimeter, area, circumference, surface area, and volume) will be supported through applications of Computer-Aided Design (CAD) software, standards of representation, problem-solving models and engineering design process.

Students will demonstrate learning through the use of 3-D printers, laser cutters/etchers and CNC Benchtop Milling Machines. Students will create innovative prototypes and 3-D masterpieces by producing designs and constructing projects. Students will further demonstrate learning through unit tests and cumulative semester exams.

Board Approved Primary Resource:

Ron Larson - McDougal Littell – 2007 – Print

ISBN: 9780618595402

Mechanical Drawing: Board & CAD Techniques

Jay D Helsel-Glencoe/McGraw-Hill-2003-Print



ISBN: 9780078251009

Basic Technical Drawing

Henry Ceceil Spewncner - John T Dygdon - James E Novak - Glencoe

McGraw-Hill -2004 -Print

ISBN: 9780078457487

**Course Recommendation:** This course is recommended for students who prefer hands-on, collaborative learning and who want to learn more about applying their knowledge to real-world projects.

**Additional Registration Information:** This course is two-period, blocked course co-taught with a Geometry and a Career & Technical Education teacher. Colleges and universities may or may not accept this course as an Arts credit. A fee will be assessed for any projects taken home. Students may purchase higher quality materials than offered as part of the course. Because of students' desires to complete homework assignments in the evening, students benefit from having a scientific calculator TI 30 or higher. A limited number of calculators will be available for students to check out for the entire year. LSHS students provide their own transportation.



## **Manufacturing, Engineering and Technology 1**

Grades: 9-12

Instructional Delivery: Face-to-face

Prerequisite: None

Location: LNHS

Semester-long course

This course fulfills the elective requirement for graduation.

**Course Description:** This course is the study of the fundamentals of manufacturing, engineering and design technology. Students will experience problem solving with engineering and design, product fabrication and manufacturing processes.

The primary units of study include metal working, welding, 3-D printing, sticker and t-shirt design, CNC plasma cutting, CNC wood routing, laser engraving and other technologies used in today's manufacturing.

Students will demonstrate learning through assessments on safety, machine operation and be required to submit projects for grade using the machines outlined above.

**Course Recommendation:** This course is recommended for students who wish to gain a basic understanding of manufacturing and engineering careers.

Board Approved Primary Resource: None

Additional Registration Information: A fee will be assessed for any projects taken home. Students may purchase higher quality materials than offered as part of the course. LSHS students provide their own transportation.



## **Manufacturing, Engineering and Technology 2**

Grades: 10-12

Instructional Delivery: Face-to-face

Prerequisite: Manufacturing, Engineering and Technology 1

Location: LNHS

Semester-long course

This course fulfills the Arts or elective requirement for graduation for the Class of 2020, 2021, and 2022.

This course fulfills the elective requirement for graduation for the Class of 2023.

Course Description: This course is the advanced study of the fundamentals of manufacturing, engineering and design technology. Students will experience problem solving with engineering and design, product fabrication and manufacturing processes.

The primary units of study include metal working, welding, 3-D printing, sticker and t-shirt design, CNC plasma cutting, CNC wood routing, laser engraving and other technologies used in today's manufacturing.

Students will demonstrate learning through assessments on safety, machine operation and be required to submit projects for grade using the machines outlined above.

Course Recommendation: This course is recommended for students who wish to gain an advanced understanding of manufacturing and engineering careers.

Board Approved Primary Resource: None

Additional Registration Information: A fee will be assessed for any projects taken home. Students may purchase higher quality materials than offered as part of the course. LSHS students provide their own transportation.



## **Manufacturing, Engineering and Technology 3 and 4**

Grades: 10-12

Instructional Delivery: Face-to-face

Prerequisite: Manufacturing, Engineering and Technology 2

Location: LNHS

Semester-long course

This course fulfills the Arts or elective requirement for graduation for the Class of 2020, 2021, and 2022.

This course fulfills the elective requirement for graduation for the Class of 2023.

**Course Description:** This course is the advanced study of applying previous learned skills in manufacturing, engineering and design technology and creating one or more independent project(s).

The primary units of study include metal working, welding, 3-D printing, sticker and t-shirt design, CNC plasma cutting, CNC wood routing, laser engraving and other technologies used in today's manufacturing.

Students will demonstrate learning through the evaluation of their independent projects.

**Course Recommendation:** This course is recommended for students who are able to independently develop manufacturing and engineering projects.

**Board Approved Primary Resource:** None

**Additional Registration Information:** A fee will be assessed for any projects taken home. Students may purchase higher quality materials than offered as part of the course. LSHS students provide their own transportation.



## **Engine Technology 1**

**Grades:** 9-12

**Instructional Delivery:** Face-to-face

**Prerequisite:** None

**Location:** LNHS & LSHS

**Semester-long course**

This course fulfills the elective requirement for graduation.

**Course Description:** This course is the study of the various power and energy systems which includes the following: small engines, hydraulics, pneumatics, solar, wind and geothermal.

The primary units of study include 2 and 4 cycle engines, hydraulics, pneumatics, solar, wind and geothermal power systems.

The students will demonstrate learning through oral and written assessments as well as teardown and reassemble of small engines and construction of various hydraulic and pneumatic systems.

**Course Recommendation:** This course is recommended for students who wish to learn more about power and energy systems using a hands-on approach.

**Board Approved Primary Resource:** None

Additional Registration Information: None



## Engine Technology 2

Grades: 10-12

Instructional Delivery: Face-to-face

Prerequisite: Engine Technology 1

Location: LNHS & LSHS

Semester-long course

This course fulfills the elective requirement for graduation.

Course Description: This course is the study of advanced power and energy systems focusing on a designed and constructed project of the student's choice.

The primary units of study include small engines, solar, wind, hydraulics, pneumatics and geothermal.

Students will demonstrate learning through evaluation of their designs and a constructed project.

Course Recommendation: This course is recommended for students who wish to learn more about power and energy systems using a hands-on approach.

Board Approved Primary Resource: None

Additional Registration Information: None



## Robotics

Grades: 9 - 12

Instructional Delivery: Face-to-face

Prerequisite: None

Location: LNHS and LSHS

Semester-long course

This course fulfills the elective requirement for graduation.

Course Description: This course is the study of the use, programming and applications of robotics in a problem-solving environment.

The primary units of study include robot commands and functions, problem solving models and the engineering design process.

Students will demonstrate learning through the designing, building, programming and testing of a robot. Students will work in teams to build a Tetrix robot specifically designed to meet a specific challenge. Problem solving skills will need to be developed, projects will need to be tested and re-engineered to meet the required outcomes.

Course Recommendation: This course is recommended for students interested in careers related to robotics, science, technology and engineering.

Board Approved Primary Resources: TBD

Additional Registration Information: None



## **Manufacturing, Metals and Welding 1**

Grades: 9-12

Instructional Delivery: Face-to-face

Prerequisite: None

Location: LNHS

Semester-long course

This course fulfills the elective requirement for graduation.

Course Description: This course is the study of the welding processes and their related technologies.

The primary units of study include Mig welding, Arc welding, Plasma and Oxyfuel cutting.

The students will demonstrate learning through written assessments in safety, hands on assessments in Mig and Arc welding processes and the Plasma and Oxyfuel cutting processes. The students will also be required to construct one welded project of their choice.

Course Recommendation: This course is recommended for students who wish to explore the field of welding technology.

Board Approved Primary Resource: None

Additional Registration Information: A fee will be assessed for any projects taken home. Students may purchase higher quality materials than offered as part of the course. LSHS students provide their own transportation.



## **Manufacturing, Metals and Welding 2**

Grades: 10 - 12

Instructional Delivery: Face-to-face

Prerequisite: Welding 1

Location: LNHS

Semester-long course

This course fulfills the Arts or elective requirement for graduation for the Class of 2020, 2021, and 2022.

This course fulfills the elective requirement for graduation for the Class of 2023.

Course Description: This course is the advanced study of the welding processes and their related technologies.

The primary units of study include Tig welding, Mig welding, Arc welding, Plasma and Oxyfuel cutting.

The students will demonstrate learning through written assessments in safety, hands on assessments in Mig and Arc welding processes and the Plasma and Oxyfuel cutting processes. The students will also be required to construct one welded project of their choice.

Course Recommendation: This course is recommended for students who wish to explore the field of welding technology.

Board Approved Primary Resource: None

Additional Registration Information: A fee will be assessed for any projects taken home. Students may purchase higher quality materials than offered as part of the course. LSHS students provide their own transportation.



## **Manufacturing, Metals and Welding 3 and 4**

Grades: 10-12

Instructional Delivery: Face-to-face

Prerequisite: Welding 2

Location: LNHS

Semester-long course

This course fulfills the Arts or elective requirement for graduation for the Class of 2020, 2021, and 2022.

This course fulfills the elective requirement for graduation for the Class of 2023.

Course Description: This course is the study of the application of all available welding processes into one or more independent project(s).

The primary units of study include welding symbols, Tig welding, Mig welding, Arc welding, Plasma and Oxyfuel cutting.

The students will demonstrate learning through the evaluation of their project(s) and a welding symbols test.

Course Recommendation: This course is recommended for students who wish to enroll into an post secondary offering and eventually enter a career in the welding industry.

Board Approved Primary Resource: None

Additional Registration Information: A fee will be assessed for any projects taken home. Students may purchase higher quality materials than offered as part of the course. LSHS students provide their own transportation.



## **Woods 1**

Grades: 9 - 12

Instructional Delivery: Face-to-face

Prerequisite: None

Location: LSHS

Semester-long course

This course fulfills the elective requirement for graduation.

Course Description: This course is the study of planning and construction of small and medium-sized woodworking projects and product development.

The primary units of study include the use of hand and machine tools incorporating methods used in industry, measurement, safety, joinery and assembly, preparation for finishes, finishing.

Students will demonstrate learning through the creation of wood projects through hands on activities, sequence steps and apply processes to complete projects and demonstrate safe equipment, tooling and lab use.

Course Recommendation: This course is recommended for students interested in careers related to manufacturing, woodworking, cabinet making and building construction.

Board Approved Primary Resources:

Exploring Woodworking fundamentals of technology

Fred W. Zimmerman/Larry J. McWard - The Goodheart-Willcox Company, Inc. – 1993 – Print

ISBN: 0-87006-997-7

Additional Registration Information: A fee will be assessed for any projects taken home. Students may purchase higher quality materials than offered as part of the course. LNHS students provide their own transportation.



## **Woods 2**

Grades: 10 - 12

Instructional Delivery: Face-to-face

Prerequisite: Woods 1

Location: LSHS

Semester-long course

This course fulfills the elective requirement for graduation.

Course Description: This course is the study of the design and construction of medium-sized to larger size woodworking projects as well as product development.

The primary units of study include the use of hand and machine tools incorporating methods used in industry, measurement, safety, joinery and assembly, preparation for finishes, finishing.

Students will demonstrate learning through the creation of wood projects through hands on activities, sequence steps and apply processes to complete projects and demonstrate safe equipment, tooling and lab use.

Course Recommendation: This course is recommended for students interested in careers related to manufacturing, woodworking, cabinet making and building construction.

Board Approved Primary Resource:

Wood: Technology and Processes

John Louis Feirer - Glencoe Div., Macmillan/McGraw-Hill – 2002 – Print

ISBN: 9780078224119

Additional Registration Information: A fee will be assessed for any projects taken home. Students may purchase higher quality materials than offered as part of the course. LNHS students provide their own transportation.



## **Woods 3 and 4**

Grades: 10-12

Instructional Delivery: Face-to-face

Prerequisite: Woods 2

Location: LSHS

Semester-long course

This course fulfills the Arts or elective course requirement for graduation.



**Course Description:** This course is the study of the design and construction of cabinet making and related furniture projects.

The primary units of study include the artistic process and foundations, hand and machine tools incorporating methods used in industry, measurement, safety, joinery and assembly, preparation for finishes, finishing.

Students will demonstrate learning through the design of individual wood projects, sequence steps and apply processes to complete projects and demonstrate safe equipment, tooling and lab use.

**Course Recommendation:** This course is recommended for students interested in careers related to manufacturing, woodworking, cabinet making and building construction.

**Board Approved Primary Resources:**

Wood: Technology and Processes

John Louis Feirer - Glencoe Div., Macmillian/McGraw-Hill – 2002 – Print

ISBN: 9780078224119

**Additional Registration Information:** A fee will be assessed for any projects taken home. Students may purchase higher quality materials than offered as part of the course. LNHS students provide their own transportation. Colleges and universities may or may not accept this course as an Arts credit.