

Mandan Public School District

7-12 Technology Education Curriculum

Mandan Public Schools

7-12 Technology Education

Curriculum



2010

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Preface

The Mandan Public Schools 7-12 Technology Education Curriculum Committee revised and updated the 7-12 Technology Education Curriculum. The 7-12 Technology Education Committee included the current draft of the North Dakota Technology Education Content Standards in the curriculum. This updated curriculum will provide Mandan Public School students with the best possible curriculum to assist our students in their career planning and career decision-making.

The 7-12 Technology Education Curriculum is articulated in two ways. First, the curriculum is presented based on the current draft of the North Dakota 7-12 Technology Education Content Standards. The committee identified each benchmark specific student skill and determined the degree to which each benchmark should be addressed in each course. The following IDM coding system was used to convey this:

- I – Introduce
- D – Develop
- M – Master.

The 7-12 Technology Education Curriculum is also articulated according to the 21st Century Skills. The committee identified which 7-12 Technology Education Curriculum benchmarks address specific 21st Century Skills. These 21st Century Skills and the match to Mandan Public Schools 7-12 Technology Education Standards can be seen in Appendix A.

The 7-12 Technology Education Curriculum IDM matrix lists all of the 7-12 Technology Education courses that are available to students at Mandan Middle School and Mandan High School. Technology Education is offered at Mandan Middle School. All of the other Technology Education courses are offered as electives at Mandan High School. Please read the course descriptions to learn more about the course content.

Thanks to the 7-12 Technology Education Curriculum Committee for their time, effort, and professionalism in working on this curriculum. I also thank the students and parents who serve on the Technology Education Advisory Committee at Mandan High School. Mandan Public Schools is fortunate to have such dedicated hardworking professionals who teach our students Technology Education courses.

Dr. Gaylynn Becker
District Curriculum/Data Director

Mandan Public Schools 2010 7-12 Technology Education Curriculum Writing Committee Members

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Vision, Mission, Slogan and Philosophy

Mandan Public School District's vision is **"Empowering excellence."** Its mission is **"Empowering every student to lead a productive life and positively contribute to society."** Its slogan is **"Mandan Schools: Where the Best Begin."**

The principal objective of the Board shall be to provide maximum educational opportunities for their students to develop in accordance with their individual needs, abilities, and level of maturity. Teachers shall make efforts to aid students to achieve their maximum development mentally, physically, socially, spiritually, and emotionally so that they may properly adjust to our complex democratic society.

The district shall back up its educational program with supporting services necessary for students' health, safety, and personal well being.

Philosophy of the 7-12 Technology Education Curriculum is:

Technology Education is about innovation. It is about how people think. It is how to apply technology in solutions of problems facing society. The aim is to solve problems and create opportunities within a realistic context. Students use their ingenuity with tools, materials, processes and resources to make creative solutions and opportunities for themselves and others. The nature of learning goes from the very early years of just knowing to more developed applications that relate engineering, assessment, innovation, and Technological Systems. It is a dynamic subject in our school that is fast moving and as up-to-date as the thinking of technology in our society. It is the future workforce thinking.

7-12 Technology Education Curriculum Codes

- I – Introduce
- D – Develop
- M – Master

Anything beyond the mastery level we assume that reinforcement will occur in the more advanced courses.

7-8 Technology Education Curriculum

<p>Standard 1: Characteristics and Scope of Technology: Recognize the characteristics and scope of technology.</p>	Applying Technology
<p>1.1 Develop new products and systems to solve problems or to help do things that could not be done without the help of technology.</p>	I/D
<p>1.2 Recognize that the development of technology is a human activity, a result of individual or collective needs, and the ability to be creative.</p>	I/D
<p>1.3 Discover how technology is closely linked to creativity which has resulted in innovation.</p>	I
<p>1.4 Examine and demonstrate how corporations can often create demand for a product by bringing it onto the market and advertising it.</p>	I
<p>Standard 2: Core Concepts of Technology: Connect the core concepts of technology.</p>	Applying Technology
<p>2.1 Model technological systems to include input, processes, output, and at times, feedback.</p>	I
<p>2.2 Relate how systems thinking involves considering how every part relates to others.</p>	I/D
<p>2.3 Differentiate an open-loop system (no feedback path and requires human intervention) with a closed-loop system (uses feedback).</p>	I
<p>2.4 Connect technological systems one to another.</p>	I/D
<p>2.5 Determine how malfunctions to any part of a system may affect the function and quality of the system.</p>	I
<p>2.6 Identify and use the requirements of parameters placed on the development of a product or system.</p>	I/D
<p>2.7 Recognize the need for careful compromises among competing factors in the trade-off decision process.</p>	I
<p>2.8 Connect how different technologies involve different sets of processes.</p>	I
<p>2.9 Show how maintenance is a process of inspecting and servicing a product or system on a regular basis (in order for it to continue functioning properly, to extend its life, or to upgrade its capability).</p>	I
<p>2.10 Identify control mechanisms or particular steps that people perform using information about the system that causes systems to change.</p>	I

<p>Standard 3: Technology Relationships: Interpret the relationships among connections between technology and other fields of study.</p>	<p>Applying Technology</p>
<p>3.1 Show how technological systems often interact with one another.</p>	<p>I</p>
<p>3.2 Illustrate how a product, system, or environment developed for one setting may be applied to another setting.</p>	<p>I</p>
<p>3.3 Correlate how knowledge gained from other fields of study has a direct effect on the development of technological products and systems.</p>	<p>I</p>
<p>Standard 4: Effects of Technology: Predict cultural, social, economical and political effects of technology.</p>	<p>Applying Technology</p>
<p>4.1 Show how the use of technology affects humans in various ways (safety, comfort, choices, and attitudes) about technology’s development and use.</p>	<p>I</p>
<p>4.2 Examine how technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences.</p>	<p>I</p>
<p>4.3 Determine how the development and use of technology poses ethical issues.</p>	<p>I</p>
<p>4.4 Identify economic, political, and cultural issues influenced by the development and use of technology.</p>	<p>I</p>
<p>Standard 5: Technology and the Environment: Investigate the effects of technology on the environment.</p>	<p>Applying Technology</p>
<p>5.1 Examine how the management of waste produced by technological systems is an important societal issue.</p>	<p>I</p>
<p>5.2 Explore how technologies can be used to repair damage cause by natural disasters and to break down waste from the use of various products and systems.</p>	<p>I</p>
<p>5.3 Investigate how decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another.</p>	<p>I</p>

<p>Standard 6: Development and Use of Technology: Examine the role of society in the development and use of technology.</p>	<p>Applying Technology</p>
<p>6.1 Illustrate new technologies that have resulted from the demands, values, and interests of individuals, businesses, industries, and societies.</p>	<p>I</p>
<p>6.2 Associate how the use of inventions and innovations has led to changes in society and the creation of new needs and wants.</p>	<p>I</p>
<p>6.3 Summarize the social and cultural priorities and values reflected in technological devices.</p>	<p>I</p>
<p>6.4 Examine why meeting societal expectations is the driving force behind the acceptance and use of products and systems.</p>	<p>I</p>
<p>Standard 7: Influence of Technology: Isolate the influences of technology on history.</p>	<p>Applying Technology</p>
<p>7.1 Investigate inventions and innovations that have evolved by using slow and methodical processes of tests and refinements.</p>	<p>I</p>
<p>7.2 Recognize that the specialization of function is at the heart of many technological improvements.</p>	<p>I</p>
<p>7.3 Understand that the design and construction of structures for service or convenience have evolved from the development of techniques for measurement, controlling systems, and the understanding of spatial relationships.</p>	<p>I</p>
<p>7.4 Describe how invention or innovation was not always developed with the knowledge of science.</p>	<p>I</p>
<p>Standard 8: Attributes of Design: Explore the attributes of design.</p>	<p>Applying Technology</p>
<p>8.1 Illustrate how design as a creative planning process leads to useful products and systems.</p>	<p>I/D</p>
<p>8.2 Infer that there is no perfect design.</p>	<p>I/D</p>
<p>8.3 Relate how requirements for a design are made up of criteria and constraints.</p>	<p>I/D</p>

Standard 9: Engineering Design: Integrate engineering design.	Applying Technology
9.1 Utilize design processes involving a set of steps, which can be performed in different sequences and repeated as needed.	I/D
9.2 Use brainstorming as a group problem-solving design process.	I/D
9.3 Transform ideas into practical solutions by modeling, testing, evaluating, and modifying.	I/D
Standard 10: Problem Solving: Translate the role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.	Applying Technology
10.1 Identify a malfunction in a technological system by using troubleshooting as a problem-solving method.	I
10.2 Differentiate between invention and innovation.	I
10.3 Solve technological problems through experimentation.	I
Standard 11: Application of the Design Process: Implement the design process.	Applying Technology
11.1 Apply a design process to solve problems in and beyond the laboratory-classroom.	I/D
11.2 Specify criteria and constraints for the design.	I
11.3 Make two-dimensional and three-dimensional representations of the designed solution.	I/D
11.4 Test and evaluate the design in relation to pre-established requirements (e.g. criteria, constraints, refine, etc.).	I/D
11.5 Make a product or system and document the solution.	I/D

<p>Standard 12: Technological Products and Systems: Use and maintain technological products and systems.</p>	<p>Applying Technology</p>
<p>12.1 Utilize information provided in manuals, protocols, or by experienced people to see and understand how things work.</p>	<p>I</p>
<p>12.2 Practice using tools, materials, and machines safely to diagnose, adjust, and repair systems.</p>	<p>I</p>
<p>12.3 Incorporate computers and calculators in various applications.</p>	<p>I/D</p>
<p>12.4 Maintain and operate systems in order to achieve a given purpose.</p>	<p>I</p>
<p>Standard 13: Impacts of Products and Systems: Assess the impact of products and systems.</p>	<p>Applying Technology</p>
<p>13.1 Design and use instruments (chart, spreadsheet, graph, etc.) to gather data.</p>	<p>I</p>
<p>13.2 Use data collected to analyze and interpret trends in order to identify the positive or negative effects of a technology.</p>	<p>I</p>
<p>13.3 Identify trends and monitor the potential consequences of technological development.</p>	<p>I</p>
<p></p>	<p>I</p>
<p>Standard 14: Medical Technologies: Relate medical technologies for selection and use.</p>	<p>Applying Technology</p>
<p>14.1 Analyze advances and innovations in medical technologies used to improve healthcare.</p>	<p>I</p>
<p>14.2 Explain how different sanitation processes used in the disposal of medical products help to protect people from harmful organisms and diseases and shape the ethics of medical safety.</p>	<p>I</p>
<p>14.3 Express how vaccines developed for use in immunization require specialized technologies to support environments in which a sufficient amount of vaccines are produced.</p>	<p>I</p>
<p>14.4 Understand how genetic engineering involves modifying the structure of DNA to produce novel genetic make-ups.</p>	<p>I</p>
<p></p>	<p></p>

<p>Standard 15: Agricultural and Related Biotechnologies: Understand, select and use agricultural and related biotechnologies.</p>	<p>Applying Technology</p>
<p>15.1 Enumerate the technological advances in agriculture directly affect the time and number of people required to produce food for a large population.</p>	<p>I</p>
<p>15.2 Identify the wide range of specialized equipment and practices used to improve the production of food, fiber, fuel, and other useful products and in the care of animals.</p>	<p>I</p>
<p>15.3 Relate how biotechnology applies the principles of biology to create commercial products or processes.</p>	<p>I</p>
<p>15.4 Explain how human made artificial ecosystem complexes replicate the natural environment.</p>	<p>I</p>
<p>15.5 Illustrate how the development of refrigeration, freezing, dehydration, preservation, and irradiation provides long-term storage of food and reduces the health risks caused by tainted food.</p>	<p>I</p>
<p>Standard 16: Energy and Power Technologies: Research and develop an understanding of how to select and use energy and power technologies.</p>	<p>Applying Technology</p>
<p>16.1 Define energy as the ability to do work.</p>	<p>I</p>
<p>16.2 Demonstrate that energy can be used to do work using many processes.</p>	<p>I</p>
<p>16.3 Identify power as the rate at which energy is converted from one form to another or transferred from one place to another, or the rate at which work is done.</p>	<p>I/D</p>
<p>16.4 Show that power systems are used to drive and provide propulsion to other technological products and systems.</p>	<p>I</p>
<p>16.5 Uncover how much of the energy use in our environment is not used efficiently.</p>	<p>I</p>
<p>Standard 17: Information and Communication Technologies: Select and use information and communication technologies.</p>	<p>Applying Technology</p>
<p>17.1 Examine information and communication systems that allow information to be transferred from human to human, human to machine, and machine to human.</p>	<p>I</p>
<p>17.2 Illustrate how communication systems are made up of a source, encoder, transmitter, receiver, decoder, and destination.</p>	<p>I</p>
<p>17.3 Interpret how the design of a message is influenced by such factors as the intended audience, medium, purpose, and nature of the message.</p>	<p>I</p>
<p>17.4 Use symbols, measurements, and drawings to promote clear communication by providing a</p>	

common language to express ideas.	I
Standard 18: Transportation Technologies: Research and develop an understanding of how to select and use transportation technologies.	Applying Technology
18.1 Identify that transporting people and goods involves a combination of individuals and vehicles.	I
18.2 Observe that transportation vehicles are made up of subsystems that must function together for a system to work effectively (e.g., structural, propulsion, suspension, guidance, control, support, etc.)	I
18.3 Explain how governmental regulations often influence the design and operation of transportation systems.	I
18.4 Examine how processes are necessary for the entire transportation system to operate efficiently (e.g. receiving, holding, storing, loading, moving, unloading, delivering, evaluating, marketing, managing, communicating, using conventions, etc.).	I
Standard 19: Manufacturing Technologies: Understand, select and use manufacturing technologies.	Applying Technology
19.1 Use mechanical processes related to manufacturing systems to change the form of materials (e.g. separating, forming, combining, conditioning, etc.).	I
19.2 Classify manufactured goods as durable and nondurable.	I
19.3 Explain how the manufacturing process includes designing, developing, making, and servicing products and systems.	I/D
19.4 Use chemical technologies to modify or alter chemical substances.	I
19.5 Determine materials that can be located and removed by extraction processes (e.g. harvesting, drilling, mining, etc.).	I
19.6 Market a product by informing the public about it as well as assisting in selling and distributing.	I

<p>Standard 20: Construction Technologies: Understand, select and use construction technologies.</p>	<p>Applying Technology</p>
<p>20.1 Show that the selection of designs for structures is based on factors (e.g. building laws and codes, style, convenience cost, climate, function, etc.)</p>	<p>I</p>
<p>20.2 Explore why structures rest on a foundation.</p>	<p>I</p>
<p>20.3 Describe why some structures are temporary while others are permanent.</p>	<p>I</p>
<p>20.4 Identify the variety of subsystems contained in buildings.</p>	<p>I</p>

9-12 Technology Education Curriculum

Standard 1: Characteristics and Scope of Technology: Recognize the characteristics and scope of technology.	Communication Technology	Design/Drafting	Energy & Transportation Tech.	Engineering Technology	Foundations of Technology	Production Technology
1.1 Analyze how the nature and development of technological knowledge and processes are functions of the setting.	I	I	I	D		I
1.2 Correlate the rate of technological development with diffusion which is increasing rapidly.	I	I	I	D		
1.3 Connect how inventions and innovations are the results of specific, goal-directed research.	I	I	I	D	I	
1.4 Explain why most development of technologies is driven by the profit motive and the market.	I	I	I	D	I	
Standard 2: Core Concepts of Technology: Connect the core concepts of technology.						
2.1 Demonstrate systems thinking that applies logic and creativity with appropriate compromises to complex real-life problems.	D	I	D	D	I	I
2.2 Show how systems (which are the building blocks of technology) are embedded within larger technological, social, and environmental systems.	D	I	D	D		I
2.3 Deduce how the stability of a technological system is influenced by all of the components in a system (especially those in the feedback loop).	D	I	D	D		I
2.4 Relate how selecting resources involves trade-offs between competing values (e.g., availability, cost, desirability, waste, etc.).	D	I	D	D	I	I
2.5 Identify and determine the criteria and constraints of a product or system	D	I	D	D	I	I

and how they affect the final design and development.						
Standard 3: Technology Relationships: Interpret the relationships among connections between technology and other fields of study.	Communication Technology	Design/Drafting	Energy & Transportation Tech.	Engineering Technology	Foundations of Technology	Production Technology
3.1 Relate how technological innovation results when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields.	D	I	D	D	I	I
3.2 Examine why technological ideas are sometimes protected through the process of patenting.	D	I	D	D		
3.3 Recognize how technological progress has advanced science and mathematics.	D	I	D	D	I	I
Standard 4: Effects of Technology: Predict cultural, social, economical and political effects of technology.						
4.1 Connect changes caused by the use of technology ranging from gradual to rapid and from subtle to obvious.	D	I	D	D	I	I
Standard 5: Technology and the Environment: Investigate the effects of technology on the environment.						
5.1 Specify how humans can devise technologies to conserve water, soil, and energy through such techniques as reusing, reducing, and recycling.			I	D	I	I
5.2 Determine considerations of trade-offs when new technologies are developed to reduce the use of resources.			I	D	I	I
5.3 Monitor various aspects of the environment to provide information for decision-making with the aid of technology.			I	D	I	I
5.4 Associate the alignment of technological processes with natural processes to maximize performance and reduce negative impacts on the environment.	I		I	D	I	I
5.5 Recognize how humans devise technologies to reduce the negative consequences of other technologies.	I		I	D	I	I

5.6 Relate how the decisions regarding the implementation of technologies involve the weighing of trade-offs between predicted positive and negative effects on the environment.	I		I	D	I	I
Standard 6: Development and Use of Technology: Examine the role of society in the development and use of technology.	Communication Technology	Design/Drafting	Energy & Transportation Tech.	Engineering Technology	Foundations of Technology	Production Technology
6.1 Compare and contrast different cultures and the development of their own technologies to satisfy individual needs, wants, and values.	I	I	I	D		
6.2 Interpret whether decisions to develop a technology is influenced by societal opinions, demands, and/or corporate cultures.	I	I	I	D		
6.3 Explain the different factors that contribute to shaping the design of and demand for various technologies (e.g. advertising, the strength of the economy, the goals of a company, the latest fads, etc.)	D	I	I	D	I	I
Standard 7: Influence of Technology: Isolate the influences of technology on history.						
7.1 Illustrate a technological development that has been evolutionary or a result of a series of refinements to a basic invention.	I	I	I	D	I	I
7.2 Report how the evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.	I	I	I	D	I	I
7.3 Summarize how technology has been a powerful force in reshaping the social, cultural, political, and economic landscape.	I	I	I	D	I	I
7.4 Specify the development of tools and machines that was based on technological know-how rather than scientific knowledge.	I	I	I	D	I	I
7.5 Examine how the Iron Age was defined by the use of iron and steel as the primary materials for tools.	I	I	I	D	I	I
7.6 Correlate how the developments of the Middle Ages produced long-lasting effects on technology and society.	I	I	I	D		
7.7 Review the important developments of history in technology during the Renaissance.	I	I	I	D		
7.8 Evaluate technological developments of the Industrial Revolution (e.g., continuous manufacturing, sophisticated transportation and communication systems, advanced construction practices, improved education, and leisure time,	I	I	I	D	I	I

etc.).						
7.9 Relate how the Information Age places emphasis on the processing and exchange of information.	I	I	I	D		
Standard 8: Attributes of Design: Explore the attributes of design.	Communication Technology	Design/Drafting	Energy & Transportation Tech.	Engineering Technology	Foundations of Technology	Production Technology
8.1 Practice the steps of a design process (e.g. defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, communicating processes and results, etc.).	I	I	I	D	I	I
8.2 Analyze why design problems are seldom presented in a clearly defined form.	I	I	I	D	I	I
8.3 Check and critique the design to redefine and improve upon it.	I	I	I	D	I	I
8.4 Explore how requirements of a design (e.g. criteria, constraints, and efficiency) sometimes compete with each other.	I	I	I	D	I	I
Standard 9: Engineering Design: Integrate engineering design.						
9.1 Distinguish how engineering design is influenced by personal characteristics (e.g. creativity, resourcefulness, and the ability to visualize and think abstractly.)	I	I	I	D	I	
Standard 10: Problem Solving: Translate the role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.						
10.1 Incorporate research and development as a specific problem-solving approach.	I	I	I	D	I	
10.2 Research solutions to technological problems.	I	I	I	D		

10.3 Realize that all problems are not technological and not every problem can be solved using technology.	I	I	I	D		
10.4 Apply a multidisciplinary approach to solve technological problems.	I	I	I	D		
Standard 11: Application of the Design Process: Implement the design process.	Communication Technology	Design/Drafting	Energy & Transportation Tech.	Engineering Technology	Foundations of Technology	Production Technology
11.1 Recommend a design problem to solve and decide whether or not to address it.	D	I	D	D	I	I
11.2 Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.	D	I	D	D	I	I
11.3 Develop and produce a product or system using a design process.	D	I	D	D	I	I
Standard 12: Technological Products and Systems: Use and maintain technological products and systems.						
12.1 Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.	D	I	D	D		
12.2 Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.	D	I	D	D	I	I
12.3 Operate systems to function as designed.	D	I	D	D	I/ D	I/ D
Standard 13: Impacts of Products and Systems: Assess the impact of products and systems.						
13.1 Collect information and evaluate quality.	D	I	D	D		
13.2 Use assessment techniques to make decisions about the future development of technology.	D	I	D	D		I

Standard 14: Medical Technologies: Relate medical technologies for selection and use.	Communication Technology	Design/Drafting	Energy & Transportation Tech.	Engineering Technology	Foundations of Technology	Production Technology
14.1 Research medical technologies which protect and maintain health (e.g., prevention and rehabilitation, vaccines and pharmaceuticals, medical and surgical procedures, genetic engineering, etc.)				I		I
14.2 Illustrate how telemedicine reflects the convergence of technological advances in a number of fields (e.g. medicine, telecommunications, virtual presence, computer engineering, informatics, artificial intelligence, robotics, materials science, perceptual psychology, etc.).				I		
14.3 Examine how the sciences of biochemistry and molecular biology have made it possible to manipulate the genetic information found in living creatures.				I		I
Standard 15: Agricultural and Related Biotechnologies: Understand, select and use agricultural and related biotechnologies.						
15.1 Classify the agricultural businesses using a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemical, and other useful products.				I		
15.2 Apply biotechnology applications (e.g. agriculture, pharmaceuticals, food and beverages, medicine, energy, the environment, genetic engineering, etc.).				I		I
15.3 Demonstrate how conservation practices control the environment (e.g. soil erosion, reduce sediment in waterways, conserve water, improve water quality, etc.).				I		
15.4 Specify the knowledge required of artificial ecosystems and the effects of technological development on flora and fauna.				I		

Standard 16: Energy and Power Technologies: Research and develop an understanding of how to select and use energy and power technologies.	Communication Technology	Design/Drafting	Energy & Transportation Tech.	Engineering Technology	Foundations of Technology	Production Technology
16.1 Explain how energy cannot be created nor destroyed; however, it can be converted from one form to another.			I	I		I
16.2 Group energy into major forms: thermal, radiant, electrical, mechanical, chemical, nuclear, and others.			I	I		I
16.3 Discuss how it is impossible to build an engine to perform work that does not exhaust thermal energy to the surroundings.			I	I		
16.4 Distinguish that energy resources can be renewable or nonrenewable.			I	I	I	I
16.5 Illustrate how power systems must have a source of energy, a process, and loads.			I	I		
Standard 17: Information and Communication Technologies: Select and use information and communication technologies.						
17.1 Demonstrate the inputs, processes, and outputs associated with sending and receiving information.	D	D	D	D		I
17.2 Information and communication systems allow information to be transferred from human to human, human to machine, machine to human, and machine to machine.	D	D	D	D	I	I
17.3 Develop information and communication systems that can be used to inform, persuade, entertain, control, manage, and educate.	D	D	D	D	I	I
17.4 Show how communication systems are made up of source, encoder, transmitter, receiver, decoder, storage, retrieval, and destination.	D	D	D	D	I	I
17.5 Integrate ways to communicate information.	D	D	D	D		I
17.6 Demonstrate ways that technological knowledge and processes are communicated through a variety of visual, auditory, and tactile stimuli (e.g. symbols, measurement, conventions, icons, graphic images, and languages that incorporate, etc.).	D	D	D	D	I	I
	C	D	E	E	Fo	Pr

Standard 18: Transportation Technologies: Research and develop an understanding of how to select and use transportation technologies.						
18.1 Relate how transportation plays a vital role in the operation of other technologies (e.g. manufacturing, construction, communication, health and safety, agriculture, etc.)		I	I	D		I
18.2 Demonstrate how intermodalism uses different modes of transportation to move people and goods easily from one mode to another (e.g. highways, railways, and waterways as part of an interconnected system, etc.).		I	I	D		I
18.3 Expand on how transportation services and methods have led to a population that is regularly on the move.		I	I	D		
Standard 19: Manufacturing Technologies: Understand, select and use manufacturing technologies.						
19.1 Service products to maintain good operating condition.	I	I	I	D	I	I
19.2 Classify how materials have different qualities (natural, synthetic, or mixed).	I	I	I	D	I	I/ D
19.3 Differentiate between durable and nondurable goods.	I	I	I	D		I/ D
19.4 Classify manufacturing systems (e.g. customized production, batch production, continuous production, etc.).	I	I	I	D		
19.5 Demonstrate how the interchangeability of parts increases the effectiveness of manufacturing processes.	I	I	I	D		
19.6 Show how chemical technologies provide a means for humans to alter or modify materials and to produce chemical products.	I	I	I	D		
19.7 Design a marketing strategy (e.g. establishing a product's identity, conducting research on its potential, advertising it, distributing it, selling it, etc.).	I	I	I	D	I	

Standard 20: Construction Technologies: Understand, select and use construction technologies.	Communication Technology	Design/Drafting	Energy & Transportation Tech.	Engineering Technology	Foundations of Technology	Production Technology
20.1 Relate that infrastructure is the underlying base or basic framework of a system.	D	D	D	D		
20.2 Evaluate why structures are constructed using a variety of processes and procedures.	D	D	D	D	I	I
20.3 Illustrate why the design of structures includes a number of requirements.	D	D	D	D	I/ D	I
20.4 Explain why structures require maintenance, alteration, or renovation periodically to improve them or to alter their intended use.	D	D	D	D	I	
20.5 Specify that structures can include prefabricated materials.	D	D	D	D	I	

Course Descriptions and Course Outlines

**Applying Technology
Grades 7-8**

Technology Education Vision

Technology Education has evolved as technology has advanced. During the industrial era of the 20th century, Technology Education was taught in the schools as Industrial Arts, reflecting the industrial society. As advancements catapulted into a faster moving, more highly sophisticated, technological society, Technology Education has made curriculum adjustments that reflect these changes. In a word, Technology Education is about Innovation! It is about how people think and how to apply technology solutions to the problems facing society. The aim is to solve problems and create opportunities within a realistic context. Students use their ingenuity with tools, materials, processes and resources to create solutions and opportunities for themselves and others. The nature of learning goes from the very early years of just “knowing” to more developed applications that relate Engineering, Assessment, Innovations and Technological Systems. It is dynamic subject in our schools that is as fast moving and as up-to-date as the thinking of technology in our society. It is future workforce thinking!

Course Description and Outline: This modular technology program is designed to develop Technology Education through the State Education curriculum guide lines. The course is designed to provide educational opportunities for all students in as many technological areas as possible. It develops confidence, self-esteem and responsibility through the successful completion of “hands-on” activities. Also, it establishes interrelationships with other courses of study utilizing the best possible tools and equipment. Technology Education at the middle school level is designed to be exploratory. The class is made-up of thirteen different module units of instruction. Students work in pairs and rotate through each module on an eight or nine day schedule. Students will only complete eight or ten rotations depending on the length of the semester.

Students will rotate through the following modules:

1. Biotechnology
2. CADD
3. CNC Manufacturing
4. Digital Transportation
5. Digital Video
6. Electricity
7. Energy, Power and Power Mechanics
8. Engineering Bridges
9. Forensic Science
10. Practical Skills
11. Research & Design
12. Robots
13. Rocket Science

Communications Technology

Course Description & Course Outline

This is a one semester course for students in grades 9-12. This is an activity-based course that provides the application of tools, materials and energy in developing, processing, using and assessing communication systems. Students will produce graphic and electronic media as they explore techniques used to apply technology communicating information and ideas

Unit Titles	Time	Planned Activities
Unit 1 Design Analysis In Communication Technologies	5 hrs	Text Research paper
Unit 2 Logo's and Sales	10 hrs	LASER applications-tile, stickers, rubber stamps, wood, rotary tool application
Unit 3 Digital Photography	10 hrs	Photographs, matting, printing Mats cut with LASER and CNC Router
Unit 4 Expression	5 hrs	3'x4' poster Corel Draw generated.
Unit 5 3-D Expressions	5 hrs	Signage -utilizing Corel Draw, tool Path, and CNC router
Unit 6 Embroidery Expressions	20 hrs	Digitizing CTE logo Digitizing school logo Hat or t-shirt sew out
Unit 7 Advertising and School Promotions	10 hrs	Find sponsor, select media type, design product prototype, research cost, finance, materials and distribution
Unit 8 Presentation	10 hrs	Power Point- using Digital Photography, Music. Text Presentation to class
Unit 9 Architectural Plans	20hrs	CADD- house plans

Design/Drafting

Course Description & Course Outline

This is a one semester course for students in grades 9-12. This course is an evolving study of modern drafting within the framework of communication technology. The course provides an experience in design and drafting as it applies in an industrial environment

Unit Titles	Time	Planned Activities
Unit 1 Careers in Drafting	2 hrs	All CADD applications Lecture and text
Unit 2 Sketching and geometry	10 hrs	Sketching and geometric constructions
Unit 3 Orthographic Projection	28 hrs	Multiview Drawings
Unit 4 Pictorials	30 hrs	Isometric, Cavalier, Cabinet drawings
Unit 5 Dimensioning	10 hrs	Dimension drawings
Unit 6 Sectional presentation	10 hrs	Sectional Drawings

Energy and Transportation Technology

Course Description & Course Outline

This is a one semester course for students in grades 10-12. This is an activity-based course that introduces students to generation, conversion, control, transmission and storage of energy. Machines and tools are used to increase strength and mechanical advantage in the movement of people and materials. Energy and transportation is equally applied to production, communication and transportation activities introduce major scientific and mathematical concepts that support energy and transportation.

Unit Titles	Time	Planned Activities
Unit 1 Atomic structure	5 hrs	Text assignments and work sheets
Unit 2 Safety	5 hrs	Text assignments and work sheets
Unit 3 Ohm's Law	8 hrs	Text and labs
Unit 4 Series circuits	5 hrs	Text and labs
Unit 5 Parallel circuits	5 hrs	Text and labs
Unit 5 Compound circuits	5 hrs	Text and labs
Unit 6 DC motors	5 hrs	Text and labs Motor kit
Unit 7 Soldering and splicing	2 hrs	Text and labs
Renewables Wiring Labs	45 hrs	Text and lab activities include: codes, outlets switches ,lamps, timers, photo controls ,thermostats, motion sensors, cords, VCR's, bells, GFCI's and low voltage applications
Leadership	3 hrs	PowerPoint TSA
Tester light	2 hrs	Develop a test light

Engineering Technology

Course Description & Course Outline

This is a one semester course for students in grades 9-12. This is an activity-based course that provides an orientation and exposure to the careers and challenges of engineering. Major engineering concepts include modeling, systems, design, optimization, technology-society interaction, and ethics. Content is provided in applied engineering graphics, communicating technical information, engineering design principles, material science, research and development processes, manufacturing techniques and systems, and opportunities and challenges of other emerging branches of engineering. Students are actively involved with the practices of various engineering fields, high-technology systems, devices and materials, engineering graphics, and mathematics/science principles.

Unit Titles	Time	Planned Activities
Unit 1 Core concepts in Technology	5 hrs	System board ,straw tower
Unit 2 Technology/society Interactions and ethics	5 hrs	Paper- Engineering Failures Technology Timeline Engineering presentation.
Unit 3 Concurrent Engineering and Team work	15 hrs	Organize company structure. Market. Advertise. Research and Develop. Produce and package. Paper rocket flight competition.
Unit 4 Modeling	25 hrs	LEGO Robotics Design and build robots to perform various tasks. Program robots. Trouble shoot and reprogram robots.
Unit 5	40 hrs	Design bridges using West Point Bridge Designer. Build File folder bridge. Test bridges. Design bridge for least amount of money challenge.

Foundations of Technology

Course Description & Course Outline

Students will gain an understanding of technology by designing and developing different engineering solutions. These concepts will be learned by using the following modules:

1. Engineering Structures
2. Vinyl Sign Making
3. CNC Lathe
4. Individual Technical Problems
5. Mini Lathe
6. Residential Construction
7. Precision Measuring
8. 3-D Modeling
9. Global Positioning System
10. Safety and Machine usage.

Engineering Structures: Students will study about, build, and test a scale model bridge. They will learn about correctly placing abutments, piers, and trusses to evaluate the effectiveness of the bridge. They will study engineering structures of the past and present, and how they have stayed the same, and in some instances changed dramatically to suit our needs.

Vinyl Sign Making: Students will learn about how to start their own business, finances, and what it means to be in your own business. Students will learn how to use a plotter, and cutting machine to design and create a project of their own.

CNC Lathe: Students will study the history of the Cartesian system and how that works for the lathe. They will learn the CAD/CAM/CNC process. Students will use the latest in CAD software to design a part to specific sizes. They will generate a NC code for their design, verify the coding works, and turn the project on the lathe.

Individual technical problem: Students will design and construct a basic woodworking project. They will demonstrate proper use of tools and the techniques used to produce the project.

Residential Construction: Students will construct a model sized house from the foundation to the roof. Each step involves reading a plan, measuring, and building or different parts of the home. They will learn how to construct walls, rafters, and flooring.

Precision Measuring: This module covers the use of precision measuring tools, form how to read a ruler in metric and English, the proper use of a micrometer, dial caliper, and depth gauge. Students will measure different objects using these methods.

3-D Modeling: Students are guided through a 3-D program in order to create, modify, and animate 3 dimensional images. They will view ports, grid parameters and the Cartesian coordinate system. They will add color, texture, and animation to images. Student also loft and extrude different images.

Global Positioning System: Students will learn how to use a GPS system, and how to link this to the computer. They will also learn how to read an atlas, and how time and distance are related.

Safety and Machine Usage: Students will learn proper safety and use of all the necessary woodworking equipment. This will be done through demonstrations, and safety tests. Students must achieve a 90% on all tests before they are allowed to utilize the shop.

Each of these module units will take approximately eight days to complete. The students are guided through each unit with the use of a textbook and MPG videos on the computer that will give them step-by-step instructions.

Production Technology

Course Description & Course Outline

Students will learn about material processing and management of the components of a production activity. The major emphasis is placed on the production, management, and transportation processes used to convert resources into structures, products, goods and services. Students will become aware of the social and environmental impacts of technology. These concepts will be learned using the following module units: CNC Mill, Material Science, Robotics, Digital Design, DVD Production, Laser Applications, Flight Simulator, Bio Technology, Computer Animation and Electronics.

The following modular units will be utilized:

1. CNC Mill
2. Material Science
3. Robotics
4. Digital Design
5. Laser Applications
6. Flight Simulator
7. Digital Design
8. Bio Technology
9. Computer Animation
10. Electronics

CNC Mill: Students will learn basic CNC programming. These skills are then transferred into a design by using CAD software. Learning these basic and necessary manufacturing fundamentals makes it possible for students to produce their own parts.

Material Science: Students will do many exercises in the process of testing, and analyzing many different materials. They will use many tools to do these activities. These include a triple beam scale, microscope, and other measuring tools to test harness, compression and displacement on a variety of materials.

Robotics: Students will learn to use and program the Scorbot, a sophisticated robot specially developed for fast learning of programming. Students will learn how robots are used in manufacturing, how to program, and direct control the robots positions and speed. Students will also learn the Cartesian coordinate grid system, how to make a flow chart, and run the robots through many different cycles.

Digital Design: Students will use photo shop software to scan, import photos from a camera, and manipulate these photos into something new. Students will use cloning tools, burning and dodging, cropping and large selection of tools from the tool pallet. Students may then use a heat transfer machine to put their idea on a shirt.

Laser Applications: From the simplest measurement of laser beams to the advanced splitting and bending of a laser beam, students will discover the many properties and uses of laser light. They will learn how to use lasers as a range finder to measure distance, and how they are used to calculate thickness of materials.

Flight Simulator: Students will use sophisticated software to learn the many instruments used to fly a plane, how to set up a flight plan, and takeoffs and landing of many different styles of aircraft. Students will also learn of the history of flight and how we got to the place in flight that we enjoy today.

Bio Technology: Students will grow plants under different conditions to compare health and growth speed of these plants. They will also use DNA mapping, and blood typing using samples, and a microscope to make observations, and record their findings. They will compare and contrast what the effects of enzymes and yeast have on a given property.

Computer Animation: By using adobe flash player students will learn how to create their own computer generated cartoon. They will design and then bring their idea to life. They will use colors, shapes, text and sound to enhance their idea on the computer.

Electronics: By using a trainer with many electronic components, students will create parallel, series and circuits using PNP transistors.

These module units will each take approximately eight days to complete. The students are guided through each unit with the use of a textbook and MPG videos on the computer that will give them step by step instructions.

Functional & Community Woods

Course Description & Course Outline

Functional & Community Woods class consists of learning challenged students. In this class we make different projects. Some of these projects all of the students will make, and other projects are chosen by the students themselves. These projects are chosen with the students' abilities in mind. The projects will be made for holidays, and in some cases made to be given to a charity. The students will learn basic skills in wood, as well as the ability to get along and work with others.

APPENDIX A

21st Century Skills – 8th Grade

The Partnership for 21st Century Skills organization in cooperation with the National Council of Teachers of English developed a 21st Century Skills Map. The 21st Century Skills Map has so far been developed at grades 4, 8, and 12.

We did an alignment between the 21st Century Skills Map and Mandan Middle School's 7-8 Grade Technology Education Curriculum. Not all of the 21st Century Skills are addressed by Mandan Middle School's 7-8 Grade Technology Education Curriculum. However, some of the skills may also be addressed by other curriculums in Mandan Public Schools. This match is a guide to assist us in the identification of which 21st Century Skills align to specific benchmarks in each grade. If someone else did the match, we would expect slightly different results.

We numbered the 12 broad 21st Century Skills 1-12. In front of each 21st Century Skill is a digit which indicates the grade level at which the 21st Century Skill was developed. Each of these 12 skills has 1 or more sub-skills. We numbered the sub-skills with a decimal point followed by another digit in numerical sequence.

The numbers in parenthesis below the 21st Century sub-skills refer to Mandan Middle School's 7-8 Grade Technology Education Curriculum. The first digit in parenthesis refers to the grade level. The second digit in the parenthesis refers to the strand. The third digit in parenthesis refers to the standard. The fourth digit in parenthesis refers to the benchmark or competency.

It is important that these 21st Century Skills be addressed by the various components of the school curriculum. As new state standards and benchmarks are developed, we hope that they will address the 21st Century Skills.

8.1 Creativity and Innovation

8.1.1 Demonstrate originality and inventiveness in work
(7-8.1.2; 7-8.1.3)

8.1.2 Be open and responsive to new and diverse perspectives

8.1.3 Develop and communicate new ideas to others
(7-8.19.6)

8.2 Critical Thinking & Problem Solving

8.2.1 Frame, analyze and synthesize information in order to solve problems and answer questions
(7-8.10.1; 7-8.10.2; 7-8.11.1; 7-8.13.1; 7-8.13.2; 7-8.13.3; 7-8.15.5)

8.2.2 Make complex choices and decisions

8.2.3 Identify and ask significant questions that clarify various points of view

8.3 Communication

8.3.1 Articulate thoughts and ideas clearly and effectively
(7-8.1.4; 7-8.9.2; 7-8.9.3; 7-8.17.4)

8.3.2 Articulate thoughts and ideas clearly and effectively through writing

8.4 Collaboration

8.4.1 Assume shared responsibility for collaborative work
(7-8.2.7; 7-8.9.1)

8.4.2 Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal

8.4.3 Demonstrate the ability to work effectively with diverse teams

8.5 Information Literacy

8.5.1 Use information accurately and creatively for the issue or problem at hand

8.5.2 Use information accurately and creatively to generate new knowledge

8.5.3 Evaluate information critically and competently
(7-8.13.2; 7-8.13.3)

8.5.4 Possess a fundamental understanding of the ethical/legal issues surrounding the access and use of information
(7-8.4.3)

8.6 Media Literacy

8.6.1 Examine how values and points of view are included or excluded and how media can influence beliefs and behaviors

8.6.2 Examine how individuals interpret messages differently, how values and points of view are included or excluded and how media can influence beliefs and behaviors

8.7 ICT Literacy

8.7.1 Use technology as a tool to research, organize, evaluate and communicate information, and possess a fundamental understanding of the ethical/legal issues surrounding the access and use of information

8.7.2 Use digital technology and communication tools appropriately to access, evaluate, and create information

8.7.3 Demonstrate an understanding of legal, ethical, and safe online behavior

8.8 Flexibility & Adaptability

8.8.1 Adapt to varied roles and responsibilities

8.9 Initiative & Self-Direction

8.9.1 Utilize time efficiently and manage workload

8.9.2 Monitor one's own understanding and learning needs

8.10 Social & Cross-Cultural Skills

8.10.1 Bridge cultural differences and use differing perspectives to increase innovation and the quality of work

8.11 Productivity & Accountability

8.11.1 Set and meet high standards and goals for delivering quality work on time

8.12 Leadership & Responsibility

8.12.1 Demonstrate integrity and ethical behavior

Appendix B

21st Century Skills – 12th Grade

The Partnership for 21st Century Skills organization in cooperation with the National Council of Teachers of English developed a 21st Century Skills Map. The 21st Century Skills Map has so far been developed at grades 4, 8, and 12.

We did an alignment between the 21st Century Skills Map and Mandan's 9-12 Technology Education Curriculum. Not all of the 21st Century Skills are addressed by Mandan's Technology Education Curriculum. However, some of the skills may also be addressed by other curriculums in Mandan Public Schools. This match is a guide to assist us in the identification of which 21st Century Skills align to specific benchmarks in each grade. If someone else did the match, we would expect slightly different results.

We numbered the 12 broad 21st Century Skills 1-12. In front of each 21st Century Skill is a digit which indicates the grade level at which the 21st Century Skill was developed. Each of these 12 skills has 1 or more sub-skills. We numbered the sub-skills with a decimal point followed by another digit in numerical sequence.

The numbers in parenthesis below the 21st Century sub-skills refer to Mandan's 9-12 Technology Education Curriculum. The first digit in parenthesis refers to the grade level. The second digit in the parenthesis refers to the strand. The third digit in parenthesis refers to the standard. The fourth digit in parenthesis refers to the benchmark or competency.

It is important that these 21st Century Skills be addressed by the various components of the school curriculum. As new state standards and benchmarks are developed, we hope that they will address the 21st Century Skills.

12.1 Creativity and Innovation

12.1.1 Develop and communicate new ideas to others

12.1.2 Demonstrate originality and inventiveness in work
(9-12.11.1; 9-12.11.2)

12.1.3 Act on creative ideas to make a tangible and useful contribution to the domain in which the innovation occurs
(9-12.1.4; 9-12.11.1; 9-12.11.2)

12.2 Critical Thinking & Problem Solving

12.2.1 Frame, analyze and synthesize information in order to solve problems and answer questions
(9-12.10.1; 9-12.10.2; 9-12.11.1; 9-12.11.2; 9-12.13.1)

12.2.2 Identify and ask significant questions that clarify various points of view

12.2.3 Exercise sound reasoning in understanding

12.3 Communication

12.3.1 Articulate thoughts clearly and effectively through writing, speaking, and multimedia
(9-12.12.1; 9-12.19.7)

12.3.2 Articulate thoughts clearly and effectively through writing
(9-12.12.1)

12.4 Collaboration

12.4.1 Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal

12.4.2 Assume shared responsibility for collaborative work

12.4.3 Demonstrate the ability to work effectively with diverse teams

12.5 Information Literacy

12.5.1 Possess and share a fundamental understanding of the ethical/legal issues surrounding the access and use of information

12.5.2 Use information accurately and creatively for the issue or problem at hand

12.6 Media Literacy

12.6.1 Understand how media messages are constructed, for what purposes and using which tools, characteristics and conventions
(9-12.17.1; 9-12.17.3; 9-12.17.4; 9-12.17.6)

12.7 ICT Literacy

12.7.1 Use technology as a tool to research, organize, evaluate and communicate information, and possess a fundamental understanding of the ethical/legal issues surrounding the access and use of information

12.7.2 Use technology as a tool to communicate information
(9-12.17.1; 9-12.17.3; 9-12.17.4)

12.7.3 Use digital technology, communication tools and/or networks appropriately to integrate, evaluate, and create information
(9-12.17.4; 9-12.17.5)

12.8 Flexibility & Adaptability

12.8.1 Work effectively in a climate of ambiguity and changing priorities

12.9 Initiative & Self-Direction

12.9.1 Go beyond basic mastery of skills and/or curriculum to explore and expand one's own learning and opportunities to gain expertise
(9-12.11.1; 9-12.11.2; 9-12.11.3)

12.9.1 Demonstrate commitment to learning as a lifelong process

12.10 Social & Cross-Cultural Skills

12.10.1 Bridge cultural differences and use differing perspectives to increase innovation and the quality of work
(9-12.6.1; 9-12.6.2)

12.10.2 Leverage the collective intelligence of groups when appropriate

12.11 Productivity & Accountability

12.11.1 Demonstrate diligence and a positive work ethic (e.g., being punctual and reliable)

12.12 Leadership & Responsibility

12.12.1 Act responsibly with the interests of the larger community in mind