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</table>
| History of AI       | 1. Start of AI  
2. AI model  
3. Computer integration  
Can a computer think?  | 1. Students will be able to explain where AI began  
2. Students will gain a basic understanding of bits and bytes  
3. Students will be able to relate the base two number system to computers  | Timeline activity  
Module questions  | Module  |  |
| Developments in AI  | 1. Logic theorist  
2. General problem solver  | 1. Students will be able to relate common games to developments in the field of AI  
2. Students will be able to explain inventions such as LT and GPS  
3. Students will see how computers are programmed to be able to beat live players  | Lab using computer games  
Module exercises  | CD with computer games, module  |  |
| Robots and AI       | 1. Computer senses  
2. Increased demand in need for AI  
3. CYE  | 1. Students will be able to explain the need for computer senses  
2. Students will explore the need for AI especially in dangerous situations  
3. Students will be able to navigate the robot CYE on the ground.  | Lab computer game  
Module exercises  
Lab programming the robot and using the map program  | CD with games, module  
Robot, camera, bluetooth software, mapping software  |  |
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| Brain vs computers | 1. Neurons  
2. Digital computers and their parts  
3. Computer vision and speech analysis | 1. Students will be able to explain the makeup and function of a human neuron  
2. Students will be able to relate a neuron to the parts of a digital computer  
3. Students will explore two areas of AI where intelligent machines have practical applications. (Vision and speech) | Module exercises  
Lab creating hot spots for CYE  
Environmental impacts lab | Module, robot, Bluetooth software, mapping software, camera |                                                                                           |
| Expert systems   | 1. computers as experts  
2. knowledge base  
3. inference engine  
4. expert transportation system | 1. Students will be able to explain why computer experts are needed.  
2. Students will be able to define what a computer based expert system is  
3. Students will be able to list the two different parts of an expert system and what they do  
4. Students will create a simple expert system on transportation | Lab using line path tool  
Module exercise | Module, robot, Bluetooth software, mapping software, camera |                                                                                           |
| Machine learning | 1. How machines work  
2. CYE & polar coordinates  
3. CYE and Cartesian coordinates | 1. Students will be able to manipulate CYE using both relative and absolute Cartesian coordinates  
2. Students will be able to manipulate CYE using polar coordinates | Module exercises  
Lab using CYE and polar coordinates  
Lab using CYE and Cartesian coordinates | Module, robot, Bluetooth software, mapping software, camera |                                                                                           |
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| Future of AI systems | 1. Neural network  
2. Fuzzy logic  
3. Career opportunities                                                                 | 1. Students will be able to explain how neural net was designed to imitate the human brain  
2. Students will be able to explain fuzzy logic and its relationship with soft failure  
3. Students will explore career opportunities in the field of AI. | Module exercises  
Lab programming and using CYE and video camera  
Careers activity | Module, robot, Bluetooth software, mapping software, camera |                                                |
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| **Into to biotechnology** | 1. Technology vs. biotechnology  
2. Four subsystems of biotechnology (human factor engineering, health care, biomass utilization, and cultivation of plants and animals) | 1. Students will be able to explain what biotechnology is and list examples of products that have been created using biotechnology techniques.  
2. Students will understand the four subsystems of biotechnology | Timeline activity  
Module exercises | Module | Bio: 1.1, 1.2, 3.3, 3.4, 3.5, 3.6 |
| **Ergonomics and microscopes** | 1. Human factors engineering  
2. Concerns of ergonomics  
3. Anthropometric data  
4. Microscope parts and uses | 1. Students will be able to explain what ergonomics is and how it is used.  
2. Student should be able to identify the three primary concerns of ergonomics.  
3. Student will be able to build a piece of ergonomically correct furniture  
4. Students will be able to use a microscope correctly and identify its parts. | Module questions  
Build an ergonomically appropriate piece of furniture for the wooden statue  
Lab using the microscope | Ergonomic model  
Microscope and slides | Bio: 1.1, 1.2, 3.3, 3.4, 3.5, 3.6 |
| **Bioengineering/bionics** | 1. Bionics  
2. Development of artificial limbs (prosthetics)  
3. Creating a | 1. Students will explore the field of bionics.  
2. Student will learn about and develop their own prosthetic arm  
3. Students will be able to explain how computers have impacted bioengineering | Module exercises  
Lab creating a prosthetic arm | Clay, paint, ergonomic model  
Mirror, paper, data sheet | Bio: 1.1, 1.2, 3.3, 3.4, 3.5, 3.6 |
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| prosthetic                     | 4. Technological advances in bioengineering  
5. Biofeedback                                | 4. Students will be able to explain what biofeedback is and how the information is used to help handicapped people.   | Lab overcoming handicap’s                              |                           |                                 |
| **Genetics and diseases**       | 1. Disease prevention  
2. Assessment of personal health  
3. Medical treatment of diseases and health problems  
4. Genetic engineering                               | 1. Students will be able to explain various methods of disease prevention  
2. Students will be able to accurately take someone’s blood pressure.  
3. Students will be able to correctly use a stethoscope  
4. Students will be able to identify various communicable and non communicable diseases  
5. Students will be able to explain the basic principles of genetic engineering | Module exercises  
Lab taking blood pressure and vitals  
Lab immunization                              | Blood pressure monitor, stethoscope  
Microscope, disease slides                     | Bio: 1.1,1.2,3,3,3,4,3.5,3.6 |
| **Biotechnology and nutrition**| 1. Hydroponics  
2. GM foods  
3. Nutraceuticals                                | 1. Students will be able to explain how hydroponics is carried out and why it is used.  
2. Students will be able to list some common GM foods and explain why they are important agriculturally to today’s society.  
3. Students will be able to explain what a nutraceutical is and where they are currently being used. | Module exercises  
Module                                      |                           | Bio: 1.1,1.2,3,3,3,4,3.5,3.6 |
| **Cells**                      | 1. Cell parts and functions  
2. DNA                                                         | 1. Students should be able to explain at least five cell parts and their function  
2. Students should understand that DNA carries | Module exercises  
Lab heredity  
PTC paper, heredity pedigree  
Microslide, microslide scope |                           | Bio: 1.1,1.2,3,3,3,4,3.5,3.6 |
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<tr>
<td>Human genome project</td>
<td>3. Students should be aware of the human genome project and be able to articulate its main purpose.</td>
<td>hereditary information</td>
<td>Lab examining cells</td>
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<tr>
<td>Environment biotechnology</td>
<td>1. Recycling 2. Sewage treatment 3. Landfills 4. Impacts of biotechnology</td>
<td>Students will explore the process of using biotechnology to rid us of never ending waste</td>
<td>Module quizzes  Lab making paper  Lab water testing</td>
<td>Newspaper, blender, deckle, screen  Water sources, PH paper, chlorine test kit</td>
<td>Bio: 1.1,1.2,3.3,3.4,3.5,3.6</td>
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<td>Students will understand the processes of using biotechnology in sewage treatment plants.</td>
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<td>Students will learn how to recycle old paper into new useable paper</td>
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<td>Students will understand the impacts biotechnology has made on society</td>
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# SUBJECT MATTER: Controls and Sensors

**Grade: 10 to 12**

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| Automation              | 1. Controls and sensors of modern machines  
2. Computers and how they are used in automation  
3. Automation software  
4. Write programs for different machines | 1. Students will be able to identify common controls and sensors used today  
2. Students will be able to operate computer automated models of machines  
3. Students will be able to operate automation software. | Module questions                                             | Module  
Text books                                      | Tech 6.3, 7.3                                       |
| Fishertechnik control system | 1. Computer software  
2. Fishertechnik control system parts, how it works, how it is used in automation | Students will be able to use the fishertechnik control system software to program and assemble models. | Module questions                                             | Module  
Control system                                      | Tech 6.3, 7.3                                       |
| Motor control           | 1. Switch assembly  
2. Model assembly  
3. Limit switches vs. remote control open switches  
4. Programming the | 1. Students will be able to create and operate a garage door operator  
2. Students will be able to use the software to control the motors direction, starting and stopping features. | Module exercises  
Lab constructing and operating a model of a garage door opener | Module  
Control system and parts                                      | Tech 6.3, 7.3                                       |
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| **Construction of a hand dryer** | 1. Function and used of a hand dryer  
2. Downloading and running a program on the built model | 1. Students will be able to assemble a model hand dryer  
2. Students will be able to write and run a program that cause the hand dryer to operate correctly | Module exercises  
Environmental impacts activity  
Lab build a hand dryer | Control system and equipment Module | Tech 6.3, 7.3 |
| **Construction of a sequential light** | 1. uses of a sequential light  
2. programming different sequences  
3. downloading and running a program on the built model | 1. Students will be able to explain how a sequential light can be used  
2. Students will be able to program their model to operate using various sequences  
3. Students will be able to correctly assemble a sequential light | Module exercises  
Lab sequential light | Control system and equipment Module | Tech 6.3, 7.3 |
| **Construction of a traffic light** | 1. Operation of a traffic light  
2. In sequence vs. out of sequence  
3. Downloading and running a program on the built model | 1. Students will be able to trouble shoot traffic light and get it in sequential order again.  
2. Students will be able to program their model to operate using various sequences  
3. Students will be able to correctly assemble a traffic light | Module exercises  
Lab traffic light | Control system and equipment Module  
Traffic light activity worksheet | Tech 6.3, 7.3 |
<p>| <strong>Construction of a sliding doors</strong> | 1. Sliding doors and operations in | 1. Students will be able to explain how automatic sliding doors function | Module quizzes | Control system and equipment | Tech 6.3, 7.3 |</p>
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<td>sliding door</td>
<td>public buildings 2. Downloading and running a program on the built model</td>
<td>2. Students will be able to correctly assemble a sliding door</td>
<td>Module exercises</td>
<td>Module</td>
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| Camera techniques    | 1. Camera shots 2. Camera composition 3. Common video editing techniques                        | 1. Students will be able to identify types of camera shots (zoom, pan, tilt, dolly etc)  
2. Student will be able to explain the importance of camera composition  
3. Students will explore various shots that frame objects. | Timeline activity  
Module questions                                      | Module                                                               |                                                |
| Editing Suite        | 1. storing video images on tape 2. understanding editing suite software 3. basic editing functions | 1. Students will be able to store video images on tape  
2. Students will be able to use the editing suite correctly.  
3. Students will be able to use the video editing software to perform basic editing techniques. | Module questions  
Lab recording videos                                      | Module  
Editing suite (VCR, tape, video monitor)                    |                                                |
| Editing concepts     | 1. When to edit 2. Cut – in editing 3. Cut- away editing                                         | 1. Students will be able to explain at least two different editing techniques.  
2. Students will perform a cut-in using editing software.  
3. Students will perform a cut-away using the editing software. | Module exercises  
Video editing concepts                                      | Module  
Monitor                                                 |                                                |
| Voice over’s, Titles and credits | 1. Title editor 2. Recording basic voice –over’s 3. Creating credits | 1. Students will be able to use the title editor tool.  
2. Students will be able to perform and record a basic voice over.  
3. Students will be able to correctly export credits into their new video. | Module exercises  
Lab create a voice over with a title and credits  
Lab environmental Impacts                                   | Editing suite  
Video tape (movie of some kind)  
Microphone                                                   |                                                |
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<td>Editing Audio</td>
<td>1. Creating a mood</td>
<td>1. Students will be able to explain how audio plays a major role in creating the mood of a scene.</td>
<td>Module exercises</td>
<td>Audio software</td>
<td></td>
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<td>2. Manipulating audio</td>
<td>2. Students will be able to use editing software to actually edit their own audio.</td>
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<td>3. Sound effects</td>
<td>3. Students will be able to explain the role of sound effects play in a video presentation.</td>
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<tr>
<td>Editing a scene</td>
<td>1. Capturing shots</td>
<td>1. Students will be able to explain what a selects project is.</td>
<td>Module exercises</td>
<td>Module</td>
<td>Video tape, VCR, monitor</td>
</tr>
<tr>
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<td>2. Assembling a sequential video</td>
<td>2. Students will be able to create their own selects project using the pinnacle software.</td>
<td>Lab capturing and assembling a sequential video</td>
<td></td>
<td>Pinnacle software</td>
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<td>3. Video presentation</td>
<td>3. Students will be able to create a complete presentation including credits and title.</td>
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<tr>
<td>Outputting a video</td>
<td>1. Video presentation</td>
<td>1. Students will be able to completely put together and output their own video presentation.</td>
<td>Module quizzes</td>
<td>Module</td>
<td>VCR, monitor, microphone, software</td>
</tr>
<tr>
<td></td>
<td>2. Careers using digital video editing</td>
<td>2. Students will be able to discuss various careers in the field of digital video editing.</td>
<td>Careers activity</td>
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<td>Lab video presentation</td>
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| Safety and Meters      | 1. Importance of safety  
2. Explore direct currents  
3. Measure current in volts and milliamperes                              | 1. Students will know the electricity safety rules  
2. Students will be able to explain DC currents  
3. Students will discover that a voltmeter measures voltage in volts and the milliammeter measures current in milliamperes                                   | Lab voltmeters  
Lab millimeter  
Module questions                              | Module  
Electricity trainer leads |
| Electric Circuits      | 1. Completes circuits  
2. various voltage sources  
3. electromotive force EMF                                           | 1. Students will be able to explain how a flashlight works electrically  
2. Students will be able to identify voltage sources of different types of electrical equipment  
3. Students will be able to explain electromotive force                                                  | Module questions  
Lab electric circuits and operation | Electric trainer  
Leads  
Module |
| Current, Voltage and resistance | 1. Electrons and their role in electricity  
2. current and closed circuits  
3. AC vs. DC  
4. voltage  
5. some materials pass currents while others do not                                               | 1. Students will be able to explain how current and voltage is related to electrons  
2. Students will be able to explain and recognize the difference between AC and DC currents  
3. Students will be able to identify materials that are resistors to current                                      | Module exercises  
Lab current  
Lab voltage drop  
Lab exploring resistance | Module  
Electric trainer  
DC circuit board |
| Conductors and Insulators | 1. Explore various metal conductors  
2. Molecular                                                              | 1. Student will be able to identify good conductors of currents and be able to explain molecularly why they are able to hold a                                                                 | Module exercises  
Environmental | Module  
Electric trainer |
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| Series Circuits | 1. Function of series circuit  
2. Make up of series circuit  
3. Calculations of voltage throughout the circuit | 1. Students will learn that series circuits only have one complete current path  
2. Students will be able to calculate voltage throughout the circuit | Lab series circuits  
Module questions | Calculator, module, | |
| Parallel Circuits | 1. Splitting of current  
2. Paths current can take  
3. Calculations of voltage | 1. Students will be able to recognize a parallel circuit and understand that current may take many paths  
2. Students will explore parallel circuits  
3. Students will be able to assemble a parallel circuit | Lab parallel circuits  
Module questions | Calculator, module, circuits | |
| Ohm’s law | 1. Relationships between the properties of current, voltage, and resistance  
2. Ohm’s law formulas and calculations  
3. Actual vs. calculated measurements | 1. Students will be able to explain the relationship between resistance, voltage and current  
2. Students will be able to calculate one of the properties (resistance, current, voltage) if two values are known  
3. Students will be able to apply Ohm’s law to both series and parallel circuits | Module quizzes  
Lab Ohm’s law  
Career activity | Module, calculator | |
**SUBJECT MATTER: Electronic Music**  
**Grade: 10 to 12**

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| Basic Music Theory | 1. Introduction into how music is written and interpreted.  
2. Pitch, tone and note duration  
3. Sharps, flats, octaves  
4. Tempo, harmony, melody, rhythm | 1. Students should be able to distinguish between melody, harmony and identify rhythm  
2. Students will be able to specify how a staff and the musical alphabet are used to document the language of music  
3. Students will be able to identify elements such as time value and tempo | Practice on the keyboard identifying musical notes(flats sharps etc and tempo) | Keyboard, musical editing equipment, module timeline and instructions |                                |
| Recording Music | 1. Digital vs. analog recording methods  
2. Familiarize themselves with different instruments used during recording sessions  
3. Multitracking  
4. Mixing down  
5. Use a MIDI studio | 1. Students should be able to explain the difference between digital and analog recording methods.  
2. Students will familiarize themselves with various types of instruments used in recording  
3. Students will examine two general stages to the recording process: multi tracking and mixing down | Use a MIDI studio to record various types of music | MIDI studio and software  
Synthesizer and mixing board |                                |
| Editing       | 1. Basic music editing (revising, reworking, rearranging)  
2. Staff and piano | 1. Students know how to use the “cakewalk music creator” software  
2. Students should know how to edit, rearrange and revise a piece of prerecorded music  
3. Students should be able to use the buttons on | Module exercises  
Edit several pieces of prerecorded music | Cakewalk software  
Prerecorded music  
MIDI studio |                                |
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<td>Composing and recording music</td>
<td>roll views and how they influence editing music</td>
<td>the Transport toolbar correctly.</td>
<td>Cakewalk software exercises</td>
<td>Cakewalk software</td>
<td></td>
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<tr>
<td></td>
<td>1. Create tracks</td>
<td>1. Students should be able to use cakewalk to create two tracks of their own.</td>
<td>Module exercises</td>
<td>Synthesizer</td>
<td></td>
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<tr>
<td></td>
<td>2. Create notes on synthesizer, playback notes and record</td>
<td>2. Students should know how to record their own notes</td>
<td>Record two tracks</td>
<td>MIDI studio</td>
<td></td>
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<td>3. Percussion instruments and how they emphasize various notes</td>
<td>3. Students will be able to explain how percussion instruments can emphasize different notes</td>
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<td>4. Students will be able to create a “rock beat”</td>
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<tr>
<td>Adding Melody</td>
<td>1. Create melody track</td>
<td>1. Students will be able to read the notes on a piece of sheet music.</td>
<td>Cakewalk quizzes/exercises</td>
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<tr>
<td></td>
<td>2. Experiment with instrument sounds on synthesizer</td>
<td>2. Should be able to play the notes correctly on the synthesizer</td>
<td>Record of melody</td>
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<td>3. Interpret musical notation on sheet music</td>
<td>3. Students will be able to record a melody track for their song keeping in time with the drum beat</td>
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<td>4. Play notes in proper time on synthesizer</td>
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<tr>
<td>Adding Bass</td>
<td>1. Remix music</td>
<td>1. Students will understand the concept using MIDI technology to remix current songs</td>
<td>Remix music</td>
<td>MIDI program</td>
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<td>2. Bass clefs</td>
<td>2. Students will be able to recognize a bass clef.</td>
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<td>Keyboard</td>
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<td>3. Alter bass sound</td>
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<td>by lowering pitch</td>
<td>3. Students will be able to alter the bass sound by lowering pitch of the notes using the keyboard.</td>
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| Adding Harmony  | 1. Music theory behind harmony  
2. Chromatic VS diatonic  
3. Record the harmony                                                                 | 1. Students will understand the musical theory behind harmony  
2. Students will be able to explain the differences between diatonic and chromatic  
3. Students will be able to interpret musical notation and record their harmony on a tape. | Module quizzes                           | MIDI program             |                                 |
|                 |                                                                                                                                                |                                                                                           | Piano/MIDI program                                      | Keyboard/ synthesizer     |                                 |
|                 |                                                                                                                                                |                                                                                           | Cassette tapes and recorder                              |                          |                                 |
## SUBJECT MATTER: Fiber Optics

### Grade: 10 to 12

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</table>
| Morse code transmission   | 1. History of Morse code  
2. Uses  
3. Development of other codes                                       | 1. Students will be able to discuss how Morse code came about  
2. Students will be able to use Morse code to send messages  
3. Students will be able to encode messages sent to them | Lab send and receive Morse code  
Module exercises | Fiber optic cables, transmitter and receiver  
Module | Technology 6.1-6.5 |
| Data transmission         | 1. Digital data  
2. Logical highs and lows  
3. Transmitting and re-transmitting  
4. Handshaking             | 1. Students will be able to explain what makes up digital data  
2. Students will be able to send and receive digital data  
3. Students will be able to explain the term handshaking | Lab send and receiving digital data  
Module exercises | Fiber optic cables, module, transmitter and receiver, cables | |
| Voice transmission        | 1. Speed of sound  
2. Magnifying sound speed  
3. Transmitting and receiving voice messages using different methods | 1. Students will be able to list how fast sound travels  
2. Students will be able to identify things that could increase the speed at which sound travels  
3. Students will be able to send and receive voice transmissions using fiber optics and a laser. | Module exercises  
Lab transmitting and receiving voice using fiber optic cable  
Lab transmitting and receiving voice using a laser beam | Transmitter and receiver, module, laser, cables | |
| Radio transmission        | 1. Units of measure  
2. Amplitude modulation (am)  
3. Frequency modulation (FM) | 1. Students will be able to explain how frequency is measured and what the measurements mean  
2. Students will be able to explain how sound waves are converted to radio waves | Lab transmission of AM and FM using a laser and a fiber optic cable. | Laser, cable, transmitter and receiver, power sources, radio | |
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<tr>
<td></td>
<td>4. Transmitting AM and FM</td>
<td>3. Students will be familiar with the two major methods of sound conversion AM and FM</td>
<td>Module exercises</td>
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<td>4. Students will actual transmit both AM and FM signals over a fiber optic cable and a laser beam</td>
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<tr>
<td>Fundamentals of optics</td>
<td>1. light descriptions characteristics of light 2. light behavior 3. rainbows and their formation</td>
<td>1. Students will be able to explain the role electromagnetic waves have with light 2. Students will be able to list the three main characteristics of light 3. Students will be able to explain what a rainbow really is and why they appear</td>
<td>Lab reflections and refraction</td>
<td>Fiber optic cable, light source</td>
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<td></td>
<td>Module exercises</td>
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<td>Laser light</td>
<td>1. Laser types 2. How to use a laser 3. Laser uses</td>
<td>1. Students will be able to explain the acronym for the word laser 2. Students will be able to explain the basic properties of laser light 3. Students will be able to show the difference between ordinary light and laser light</td>
<td>Lab laser light versus ordinary light</td>
<td>Laser, module, light source</td>
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<td>Lasers</td>
<td>1. Parts of a laser 2. Laser uses and real world application 3. Using a laser correctly</td>
<td>1. Students will be able to identify the three main parts of a laser. 2. Students will be able to give several examples of where lasers are used in the world today</td>
<td>Module exercises  Career activity Lab laser lights</td>
<td>Lasers, module</td>
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| Aviation   | 1. History of aviation  
2. Major parts an airplane and their function  
3. Flight simulator | 1. Students will be able to discuss the major events in the history of flying.  
2. Students will be able to locate five major airplane parts and be able to describe their function  
3. Students will take an introductory flight lesson on the flight simulator | Matching exercise  
Module flight | Flight simulator software and yoke& rudders module | Does not line up with frameworks |
| Controls and Instruments | 1. Plane construction  
2. Yoke, rudder, throttle  
3. Instrument panel and function | 1. Students will be able to construct and fly their own wooden plane  
2. Students will be able to point out and explain the function of the yoke, rudder and throttle  
3. Students will be able to identify key elements such as altimeter | Module questions  
Lab plane construction | Model plane, glue, worksheet | |
| Taxiing    | 1. Driving the plane  
2. Taxiing using the flight simulator | 1. Students will be able to explain what taxiing actually is  
2. Students will be able to taxi using the flight simulator | Module exercises  
Lab practicing taxiing on flight simulator | Flight simulator software | |
| Takeoff    | 1. Steering  
2. Plane velocity  
3. Lift | 1. Students will learn the correct way to lineup a plane  
2. Students will be able to explain the effect has on a planes velocity  
3. Students will be able to use the flight simulator to correctly take off. | Module exercises  
Lab flight simulator | Flight simulator module | |
| Flying     | 1. Forces on a plane (drag, lift, weight, thrust)  
2. Leveling off | 1. Students will be able to explain the major forces acting on their aircraft  
2. Students will be able to use the flight simulator to change direction and to level off. | Module exercises  
Lab flight simulator flying | Flight simulator | |
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<td>3. Change direction using a compass</td>
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<td>Landing</td>
<td>1. How to land 2. Dangers involved in landing 3. Landing using flight simulator</td>
<td>1. Students will be able to list the dangers of landing an aircraft 2. Students will be able to land safely using the flight simulator</td>
<td>Module exercises Practice landing flight simulator Flight simulator</td>
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<tr>
<td>Solo flight and licenses</td>
<td>1. Requirements for permits and licenses 2. Types of licenses 3. Instrument rating</td>
<td>1. Students will be able to explain the difference in a permit vs. a license requirement 2. Students will be aware that there are more than one type of license 3. Students will be able to explain what the different instrument rating mean</td>
<td>Module quizzes Career activity Lab solo flight simulator Flight simulator</td>
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| **History of plastics** | 1. Development of plastics  
2. Natural vs. synthetic  
3. Evolution of synthetic plastics  
4. Commercial uses of plastics particularly celluloid | 1. Students should understand that plastics have been used for centuries  
2. Students should be able to name and explain both natural and synthetic plastics  
3. Students should be able to recognize and explain how plastics are used today. | Timeline activity  
Module exercises | Module timeline and instructions |                                 |
| **Vacuum forming** | 1. Celluloid vs. bakelite plastics  
2. Color range and how it was achieved  
3. Vacuum forms | 1. Students will be able to explain the difference between celluloid (partial synthetic)  
2. Understand how the creation of powder colors helped allow plastics to be different hues  
3. Students should know how to correctly use a vacuum form machine | Module questions | Vacuum molding machine, molds, plastic sheets |                                 |
| **Basic chemistry of plastics** | 1. structure of plastics  
2. mixture vs. pure substance (compound and element)  
3. properties of matter  
4. bonding  
5. isotopes, nucleus and parts  
6. Physical vs. | 1. Students should be able to define matter  
2. Students should be able to give examples of a mixture and of a pure substance  
3. Students should be able to understand the concept between ionic and covalent bonds  
4. Students should be able to identify the parts of an atom and their function  
5. Define a chemical reaction and carry out an experiment to demonstrate one | Module exercises  
Chemical reaction lab | Dish detergent, metal dish, test tube, sodium tetraborate, water, periodic table |                                 |
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| Properties of plastics | 1. Classification of plastics  
2. Thermoplastics vs. thermosets  
3. Polymerization | 1. Students will be able to classify plastics based on molecular structure and response to heat  
2. Students will understand the difference between thermoplastics and thermosets  
3. Students will be able to name the building blocks of polymers and explain the process of polymerization.  
4. Students will be able to carry out a polymerization lab | Module exercises  
Lab fluid polymer lab  
Molding lab | Molding machine, plastic sheets, molds  
Water, test tube, detergent |                                |
| Injection molding | 1. Nature of injection molding pressure vs. heat  
2. Parts of an injection mold  
3. Injection mold operations | 1. Students will understand the concept of injection molding  
2. Students will be able to identify the parts of an injection molding machine  
3. Students will be able to operate an injection molding machine  
4. Students will produce a product using the molding machine | Module exercises  
Lab making a screwdriver  
Lab making a key chain | Plastic beads, injection molding machine, safety gloves and goggles, molds, screwdriver part, key ring, powder coloring |                                |
| Characteristics of thermosetting resins | 1. Thermosetting resins  
2. Phenolics  
3. Areas  
4. Melamine  
5. Polyesters  
6. Epoxy resins  
7. Silicones | 1. Students will be able to explain characteristics of thermosetting resins  
2. Understand that some naturally occurring materials can be made synthetically  
3. Students will understand properties of different resins such as polyesters, epoxy and melamine  
4. Students will be able to explain why silicones are considerably different type of | Modules exercises  
Polymer experiments using injection molding | Injection molding machine, plastic beads, color dust, molds |                                |
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| Characteristics of Acrylics | 1. Uses /characteristics of polyethylene and polystyrene  
2. Uses/characteristics of nylon (polyamide)  
3. Polyvinyl used as rubber substitute  
4. Careers in plastics | 1. Students will understand the versatility of many acrylics  
2. students will be able to identify different types of plastics based on their characteristics  
3. Students will explore various careers in the field of plastics. | Module quizzes  
Career exploration  
Lab using acrylics | Module, handouts and text on careers, various types of acrylics and thermosetting plastics |                              |
# SUBJECT MATTER: Space and Rocketry

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| History of Space Studies    | 1. Ptolemy  
2. N.Copernicus  
3. Galaxies                                                                                       | 1. Students will be able to compare and contrast the Ptolemy model with that of Copernicus  
2. Students will be able to identify the true solar system model  
3. Students will be able to explain what makes up a galaxy and identify which galaxy we live in. | Timeline activity  
Module exercises                                                                                                               | Module                                                                                                               | Earth Science 4.1 |
| Early Space Exploration     | 1. History of rockets  
2. Newton’s third law  
3. Early space missions                                                                 | 1. Students will be able to explain who first used rockets.  
2. Students will be able to relate Newton’s third law to rocket launches  
3. Students will be able to explain the Apollo 11 mission and its current day controversies | Lab build model rocket  
Module exercises                                                                                                               | Module  
Rocket, glue, ruler                                                                                                            | ES 4.1 |
| Space Shuttle               | 1. Shuttle design  
2. Three main shuttle components  
3. launches and missions                                                                 | 1. Students will be able to explain why a space shuttle is reusable.  
2. Students will be able to explain the function of the three main components of a shuttle  
3. Students will be able to correctly and accurately use the space simulator software.  
4. Students will be able to discuss several space missions in addition to the Apollo 11 mission. | Module exercises  
Lab using space simulator software                                                                                           | Space software                                                                                                          | ES 4.1, 4.3 |
| Working in Space            | 1. Living in space  
2. International space station                                                                 | 1. Students will be able to explain the major obstacles of living in space and be able to discuss how they are overcome.  
2. Students will be able to discuss the major functions of the international space station | Module exercises  
Environmental activity  
Computer research                                                                                                               | Internet, module, worksheets                                                                 | ES 4.1-4.3 |
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<td>Solar System</td>
<td>1. Sun 2. Orbits 3. Planets</td>
<td>1. Students will be able to explain the rotation of the planets and the importance of the sun. 2. Students will be able to name the eight planets and match basic statistics to each one. 3. Students will successfully use the space simulator to conduct “missions” to several of these planets</td>
<td>Module exercises Lab solar system</td>
<td>Worksheet solar system module, space simulator software,</td>
<td>ES 4.1-4.3</td>
</tr>
<tr>
<td>Deep Space and surroundings</td>
<td>1. Space colonies 2. Galaxies 3. Nova stars, nebulae</td>
<td>1. Students will be able to explain what a space colony is 2. Students will be able to use the stargazers program to properly identify nova stars and super nova stars. 3. Students will be able to explain what galaxy we live in and name galaxies that are near ours.</td>
<td>Lab stargazer’s log</td>
<td>Space software</td>
<td>ES 4.2</td>
</tr>
<tr>
<td>Technology that results from Space</td>
<td>1. Technology 2. Rocket launch</td>
<td>1. Students will be able to explain at least two new technologies that resulted from a space mission 2. Students will be able to successfully launch their rockets</td>
<td>Module quizzes Lab rocket launch</td>
<td>Rockets, battery pack, launch tube, engines,</td>
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<td><strong>Forces in structure</strong></td>
<td>1. Forces 2. Equilibrium 3. Loads 4. Compression vs. tension</td>
<td>1. Students will be able to explain the relationship of force to gravity</td>
<td>Lab equilibrium</td>
<td>Playing cards</td>
<td>Technology 1.1-1.5, 2.1-2.4</td>
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<td></td>
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<td>2. Students will be able to demonstrate equilibrium</td>
<td>Lab Loads</td>
<td>Boards, weights, beams</td>
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<td>3. Students will be able to name the three main types of loads</td>
<td>Module exercises</td>
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<td>4. Students will be able to explain the difference between tension and compression</td>
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<td><strong>Stress</strong></td>
<td>1. Stress applications 2. Stress analyzer 3. Tension and compression 4. Torsion</td>
<td>1. Students will be able to explain what stress actually is.</td>
<td>Module exercises</td>
<td>Stress analyzer, stress boards</td>
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<td>2. Students will be able to safely use and extrapolate data from the stress analyzer.</td>
<td>Lab stress analyzer</td>
<td>Chalk</td>
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<td>3. Students will be able to calculate the amount of stress placed on an object</td>
<td>Lab torsion</td>
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<td>4. Students will understand the concept of torsion and will be able to demonstrate it.</td>
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<td><strong>Physical properties of building materials (non-synthetic)</strong></td>
<td>1. choosing materials based on their physical properties 2. physical properties 3. Hooke’s law</td>
<td>1. Students will understand how architects choose their building materials</td>
<td>Module exercises</td>
<td>Cubes of various materials, periodic table, balance</td>
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<td>2. Students will be able to accurately describe physical properties of building materials (tensile, hardness, corrosion etc)</td>
<td>Lab testing stress of reinforced materials</td>
<td>Rubber band, ruler, spring scale</td>
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<td>3. Students will be able to apply Hooke’s law.</td>
<td>Lab Hooke’s law</td>
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<td><strong>Testing materials force and stress</strong></td>
<td>1. Description of properties 2. Synthetic materials 3. Polymers</td>
<td>1. Students will be able to describe properties of commonly used materials (brick, iron steel)</td>
<td>Module exercises</td>
<td>Samples of materials</td>
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<td>2. Students will be able to create a box beam and test it on the stress analyzer</td>
<td>Lab stress analyzer</td>
<td>Stress analyzer</td>
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<td>3. Students will be able to explain what a</td>
<td>Lab testing stress of reinforced materials</td>
<td>Box beam supplies</td>
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| **Shapes and Forces 1** | 1. Construction (post and lintel, arches, tetrahedron geodesic dome etc)  
                      2. Building a roman arch  
                      3. Geometric shapes                                                                                                                                                                                                         | 1. Students will build an arch that could hold the weight of an average person  
                      2. Students will be able to compare common construction method.  
                      3. Students will be able to build several geometric shapes                                                                                                                                  | Lab roman arch  
                      Lab building geometric shapes  
                      Module exercises                                                                                                                                  | Roman arch kit  
                      Beams and wooden sticks                                                                                                                                |                                                                                   |
| **Shapes and forces 2** | 1. History of bridges  
                      2. Bridge design  
                      3. Arch bridges                                                                                                                                                                                                              | 1. Students will be able build a truss.  
                      2. Students will be able to explain the advantages and disadvantages of basic bridge design  
                      3. Students will be able to explain the progression of bridges over time.  
                      4. Students will be able to name the three most common types of arches.                                                                                       | Lab stress analyzer and geometric shapes  
                      Lab design and build a bridge  
                      Module exercises                                                                                                                                  | Geometric shapes, beams, glue pins                                                                                                                        |                                                                                   |
| **Building a structure** | 1. Architect sketches and blueprints  
                      2. Models to scale  
                      3. Careers                                                                                                                                                                                                                 | 1. Students will be able explain what a blueprint is and how it is used  
                      2. Students will be able to draw a model to scale.  
                      3. Students will be able to explain at least three careers in this field.                                                                                   | Module exercises  
                      Career activity  
                      Scale drawing activity                                                                                                                                  | Graph paper, ruler, object                                                                                                                             |