Technology & Engineering
Seymour High School

Manufacturing Technology

Module and Master Project Overviews

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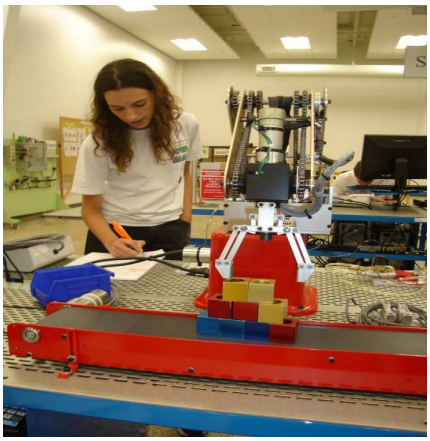
Manufacturing Technology Overview

The High School Manufacturing Program is designed to promote interest in manufacturing careers. Prospective manufacturing students have the opportunity to take three Manufacturing courses beginning in the ninth grade. The courses are designed to increase the student's technological literacy and problem solving skills, introduce career opportunities in technology and engineering, and provide opportunities for the students to learn and experiment with engineering design principles. The courses are delivered through enterprise systems, modules, and master projects. Below is an overview of the Manufacturing modules and master projects.

Modules



Robotics

- Robot Programming Commands
- Program Design
- General Computer Language Concepts
- Robot Applications Design
- Robot Simulation

Computer Aided Design

- Product Design Concepts
- Process Design Concepts
- CAD Fundamentals
- Schematics
- Sectional Drawings

AC/DC Electrical Systems

- Principles of Voltage and Current
- Principles of Resistance, Inductance and Capacitance
- Principles of Electrical Power
- Component Operation
- Circuit Protection

Graphic Design

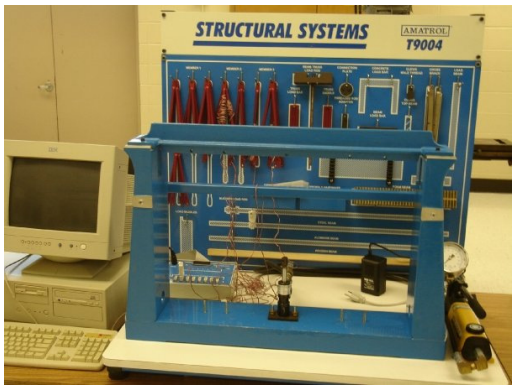
- Working with Color
- Freehand Software Design Tools
- Graphic Design Principles
- Digital Cameras and Scanners
- Editing Images
- Adobe Photoshop

Desktop Publishing

- Desktop Publishing Basics
- Type and Paragraph Formatting
- Graphic Elements
- Document Output
- Multi-page Publishing

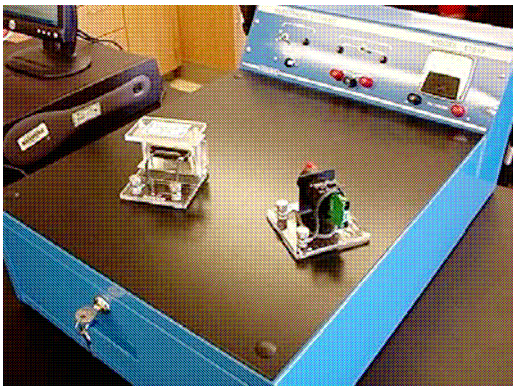
Internet Marketing

- Internet Use
- Internet Concepts
- Webpage Design
- Website Content
- Front Page Software Design Tools



Structural Engineering

- Building and Bridge Design
- Strain Gauge Measurement
- Bending Moment Calculations
- Beams and Structural Loading Analysis
- Static Force Calculations



Electrical Control

- Digital Logic
- Principles of Electrical Control
- Ladder Diagrams
- System Operation/ Applications
- Design of Basic Relay Control Circuits

Pneumatics

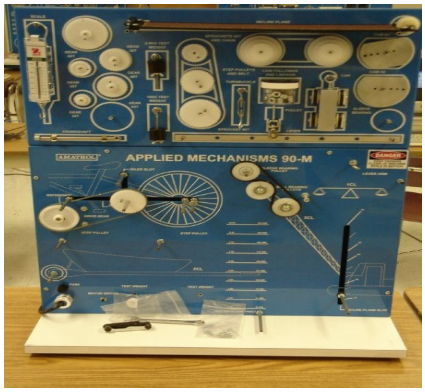
- Principles of Flow and Pressure
- Component Operation
- Power Generation Principles
- Design of Circuits
- Simulation of Circuit Design

Computer Control

- Programmable Controller Operation
- Ladder Logic Program Concepts
- PLC Program Interpretation
- PLC Applications
- PLC Timers and Counters

Thermal Systems

- Temperature Measurement and Conversion
- Thermal Physics
- Thermodynamic Laws
- Heat Transfer Methods
- Heat Transfer Calculations



Mechanical Systems

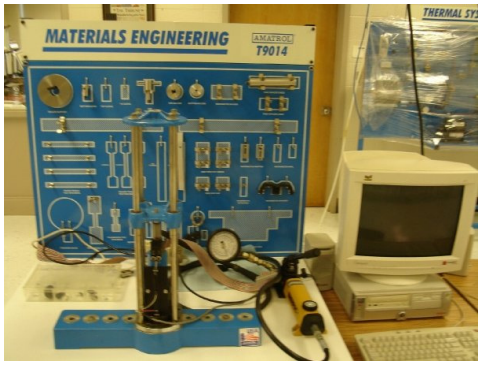
- Physics Principles of Speed, Acceleration, Force, Mass, and Friction
- Calculation of Mechanical Power, Torque, and Speed
- Speed Reduction Calculation
- Chain Drive Operation and Design
- Belt Drive Operation and Design

Plastics

- Polymer Creation
- Chemical Reactions and Processes
- Plastics Applications
- Injection Molding Operation

Mechanical Drives

- Physics Principles of Momentum, Speed, Acceleration, Forces, Mass, and Friction
- Measurement of Mechanical Efficiency
- Speed Reduction Calculation
- Gear Drive Operation and Design
- Belt Drive Operation and Design



Materials Engineering

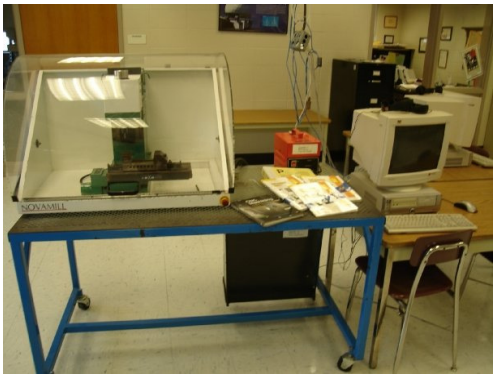
- Non-Destructive Testing Concepts
- Destructive Testing Concepts
- Tensile Testing
- Compression Testing and Shear Testing

Machine Tools

- Material Identification
- Material Layout and Hand Tools
- Band saw Setup and Operation
- Sander Setup and Operation
- Drill Press Setup and Operation

Quality Assurance

- Measurement Systems
- Rule/ Caliper/ Micrometer Measurement
- Dial Indicators
- Tolerance/ Gauging
- Digital Measurement Tools



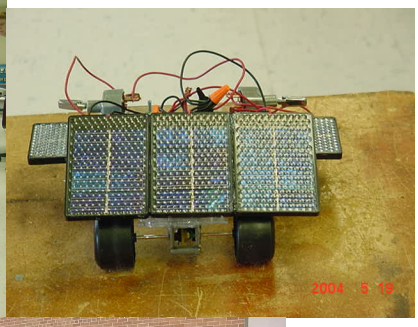
CNC Machines

- CNC Mill Programming and Design
- CNC Mill Setup and Operation
- Tool Position Calibration
- Fixture Design
- Feed and Speed Calculation

Additional modules not features are Hydraulics and Electrical Motor Control.

Master Projects

Master projects are comprehensive instructional units designed for students to demonstrate their working knowledge gained from their Amatrol Modules. The master projects are six week long units that consist of a company name, logo, web site, research papers, power point, company shirts, working prototype and a forty minute presentation to the class. Each group forms a company for the master project and elects a president, vice president, treasure, and a secretary. These job titles are integrated into the project to bring in a real world working atmosphere. Below are excerpts from the design briefs that the students receive at the beginning of their projects.



Can Crusher Project

PROBLEM STATEMENT: You work for Edison Engineering and Consulting, Inc. A customer of your company, Acme Automotive Manufacturing Co., has just received a notice from the company that disposes of their aluminum soft drink cans indicating that the total volume of their cans must be reduced by 70%. If this is not done, your company will have to pay an increased fee of $ 0.05 U.S. dollars per can. As a result, they have contacted your firm about the possibility of reducing the volume of the cans.

CHALLENGE: Work in a team and use the seven steps of the design process to design and build an automated can crusher that reduces the volume of cans by at least 70%.

Solar Project

PROBLEM STATEMENT: You work for Solar Plant, a solar panel production facility that uses the sun to produce energy. Your solar panels are shipped to remote locations for use in power plants that produce electricity where other sources are not available. Another company, that makes battery-operated lunar vehicles, wishes you to help them. Thus far, lunar vehicles could only be used until their batteries ran down. This greatly limits the operational capacity of the lunar vehicles. Using solar power to charge the batteries, they have already solved half of the problem. However, due to the moon's rotation and depending on the position of the earth, the moon can be in darkness for extended periods of time, making round-the-clock solar power impossible.

CHALLENGE: Work in a team and use the seven steps of the design process to design and build a solar-powered energy plant that can be used to charge the batteries of a lunar vehicle in darkness. In daylight, the same solar panels that provide power to your plant will also handle the chore of charging the vehicle's batteries.

Mag Lev Train Project

PROBLEM STATEMENT: Your company has been contracted by Amtrak to connect the cities of Atlanta, GA; Chattanooga, TN; Nashville, TN; and Louisville, KY with a rail system. Currently, Amtrak only provides service between these cities on buses. Amtrak's plan is to add a rail system to connect these cities, using a switching station just north of Chattanooga to direct trains either north to Louisville or northwest to Nashville. Amtrak wants to use a magnetic-levitation train in this situation. This will be Amtrak's chance to test customer response to maglev technology. They are excited about the possibility of converting their entire existing rail system to a maglev system to improve speeds and efficiencies, helping to keep them competitive with the airline market. They have asked you first to develop a working prototype of the levitation system, the track switching system, the train loading system, and the train automation system.

CHALLENGE: Work in a team and use the seven steps of the design process to design and build a working prototype of the maglev system.

Hovercraft Project

PROBLEM STATEMENT: You live in a city that is separated from the ocean by various types of terrain. This terrain includes sand, a river, and a patch of quicksand that makes road construction impossible. For years, the businesses in your city have had to transport their ocean-going cargo around the impassable terrain via distant coastal highways, which are very expensive. You have an idea to start a business called All-Terrain Ferry Co. that will ship cargo from the business district directly to the ocean docks.

CHALLENGE: Work in a team and use the seven steps of the design process to design and build a hovercraft vehicle that can be piloted over several types of terrain. You must also build a dock from which cargo can be loaded and your hovercraft launched.

Ergonomic Workstation Project

PROBLEM STATEMENT: A manufacturing company has called in your engineering consulting team to look at an assembly process where employees have incurred repetitive motion injuries and high absenteeism, which has cost the company greatly in lost production and high worker compensation costs. One area of concern is the employee workstation. The workstation is one where employees assemble kits of decorative plastic balls of various sizes for sale at craft shops. After reviewing the assembly process first hand you observe a number of characteristics about the design of the process that likely are causing the problems. Problems include: no adjustability of height or reach of various components to accommodate different worker body sizes workers must reach across a 4 foot span to obtain a kit, assemble it and stack it.

CHALLENGE: Work in a team and use the seven steps of the design process to design and build an assembly workstation that will reduce repetitive motion, injuries and absenteeism through good ergonomic design and by automating the feeder and storage steps of the process.

Handicap-Assist Lifting Device

PROBLEM STATEMENT: A worker in your company's manufacturing plant has been injured in an accident while away on vacation. One arm is completely useless, and the other arm cannot lift heavy object or perform fine motor skills. Although his situation is not permanent, it is expected to be several months before he is back to full strength in both arms. After his initial hospital stay, he is planning to return to work, and in order to comply with the Americans with Disabilities Act, your company has decided that the

employee will keep his old job. His workstation will be modified to allow him to perform the job with his limited arm usage. His job is to pick up a ream of paper, visually inspect it for defects, and then mark good reams with a 3-digit serial number, and mark bad reams with a big X. Once the reams are marked, good reams are placed in a shipping container. When the shipping container is full, the container is sent on to the next station. His new workstation will need to do the lifting of the part, but not the movement of the part. The worker will effectively be working with a weightless product In addition, a method of writing numbers on the part needs to be available, as well as a way to turn off the lifting device when the product has been placed into the shipping container.

CHALLENGE: Work in a team and use the seven steps of the design process to design and build a Handicap Assist Lifter system to allow your co-worker to continue to perform his job.

Automated Drawbridge Project

PROBLEM STATEMENT: You work as a project engineer for CNC Constructors, a highway and bridge construction company. Your company is going to bid on the two bridge construction projects that will connect Louisville, Kentucky to Southern Indiana. The construction time frame for the two new bridges could take at least 10 years to complete. However, the automobile traffic congestion around Louisville and Southern Indiana demands that a bridge be quickly constructed to help relieve the congestion. This bridge must be capable of accommodating all types of river traffic while providing a span for automobiles to cross. In addition, the City of Louisville is striving to improve the riverfront area through beautification projects and by creating more public access sites to the river. Therefore, the City of Louisville has requested a marina be constructed near the bridge. Your company has decided to develop a drawbridge to provide relief for the current traffic congestion and a related marina.

CHALLENGE: Work in a team and use the seven step design process to design a drawbridge and boat storage/retrieval system that follow the constraints.

Hydroponics Project

PROBLEM STATEMENT: You are a biologist working for AgSCo, Agricultural Solutions Company. The arctic nation of Nariz Azule has hired AgSCo to help develop an agricultural solution to their problem. Nariz Azule is covered in snow all 365 days of the year. In addition, their nine-month winter brings a long period in which there is no sunlight. Until now, they have imported all of the food they need. However, their growing population makes this more and more difficult. You have been assigned to develop a solution so that Nariz Azule may grow its own food.

CHALLENGE: Work in a team and use the seven steps of the design process to design and build an automated hydroponics garden that grows plants without soil or natural sunlight.
Additional projects not features are Smart Home Design and Steam Engine Catapult.
For additional information on Manufacturing Technology contact Seymour High School.

Course names:

Manufacturing Systems
Manufacturing Processes
Advance Manufacturing - MSSC