PLTW: Computer Integrated Manufacturing

Course Description:

The curriculum for this course is developed by Project Lead The Way (PLTW). This elective course is a 2 Trimester Course. In this Project Lead the Way engineering course students will study and apply various concepts associated with how computers are integrated into manufacturing. The class is split into four main units of study. The first unit of study is Principles of Manufacturing which concentrates on computer control systems. The second is Manufacturing Processes with an emphasis on G&M code and CNC machining. The third unit is Elements of Automation, which is a broad study of robotics. The fourth unit combines the other areas into one integrated factory system. Students that successfully complete all of the requirements for this course, maintain a "B" average and earn a score above a 3 on the End of Course assessment can apply for college credit through various universities. The class is fully weighted. The information in this course overview outlines what students should understand and be able to do by the end of the trimester.

Mastery Standards:

Argue design processes vary slightly. However, key elements of any design process include: defining a problem, identifying criteria, generating solutions, creating a model or prototype, testing and evaluating, refining design and communicating processes and results. ENG1.a.11.h

Analyze the process of engineering design accounts for a number of factors to make decisions. ENG2.a.8h

Research and development is a specific problem solving approach that is used extensively in business and industry to prepare devices and systems for the marketplace. ENG3.a.7.h

Develop and produce a product or system using a design process. ENG4.b.5.h

Troubleshoot, analyze and maintain systems to ensure proper function, accuracy and precision. ENG5.b.9.h

Unit	Description of Unit and Learning Targets
Unit Title: 1 Essential Questions: ● How do various manufacturing systems incorporate control systems (PLC's) to control system inputs and outputs to achieve a desired end goal and how does the costing of systems affect the design, function and desired output?	Students will... Learning Targets: ● I can identify and describe various manufacturing systems used in industries. ● I can use flow charts to break down complex tasks into individual components. ● I can program a Vex Cortex using RobotC language. ● I can program inputs & outputs using RobotC language. ● I can use open and closed loop systems in RobotC language. ● I can work with a group of peers to design and construct a manufacturing transfer system using Vex components. ● I can use various digital sensors with computer coding to automate the transfer system. ● I can analyze the transfer system when completed for efficiency and accuracy of products produced. ● I can test the prototype one step at a time using the testing procedures and document the results for a detailed report indicating the findings using data. ● I can create a presentation using Google slides and communicate orally to an audience the design process and detailed elements of the solution to the problem.

	● I can interpret information from experts and evaluate the next steps in the design process.
Unit Title: 2 Essential Questions: ● How do we communicate technically with 3D modeling software, CAM and G&M code to transform materials into intricate and useful products?	Students will... Learning Targets: ● I can identify and use common G&M program language to write code for a part. ● I can use straight line interpolation to create cutting paths. ● I can use two methods of cutting arcs using G&M code. ● I can create toolpaths in absolute and relative positioning. ● I can utilize the features on Inventor to draw parts for a product. ● I can utilize Inventor to CAM part toolpaths and create G&M code after simulation of cutting. ● I can cut parts using the cut files produced from the Inventor post processor.
Unit Title: 3 Essential Questions: ● How do you use robotics to affect manufacturing automation, what are the constraints of robots and how are they programmed to do various tasks?	Students will... Learning Targets: ● I can identify the different parts of a robot, identify constraints by their work envelopes and explain the function of the parts including the end actuators. ● I can program robot part paths using a robotics simulator. ● I can compute horsepower, fluid power and torque as it relates to robotic power. ● I can program a pick & place move with a lynx robot and loop the program. ● I can use Vex system inputs to control the Lynx robot. ● I can actuate the Lynx robot with another robot or Vex and can also send signals to actuate other devices from a Lynx. ● I can handshake a lynx robot to a lynx robot. ● I can handshake a lynx robot to a Vex system.
Unit Title: 4 Essential Questions: ● How do we integrate multiple systems into a working factory simulation using Vex, Rapid Prototyping, Manufacturing and Lynx robots?	Students will... Learning Targets: ● I can work cooperatively in a team to design a factory system utilizing multiple cells and systems that will be integrated. ● I can handshake systems to allow parts to flow along the factory system. ● I can integrate safety stops in the factory system. ● I can program the Vex systems with Lynx robots and back again to loop parts in the factory system. ● I can troubleshoot errors in coding and handshaking signals with the factory system.