

B. COURSE CONTENT

Course Outline: *A detailed descriptive summary of all topics covered. All historical knowledge is expected to be empirically based, give examples. (i.e. California State Standards).*

Introduction

Students in this course are already familiar with the Paxton Patterson online cloud-based learning management system, but will spend a few hours refreshing their skills from the previous year and investigating new features on the CareerPlus2 system. Students master the system utilizing digital fluency and information literacy. In this course, students take responsibility for their own learning. In the intro. section, students will be placed in groups of 6-8 students and work on team dynamics prior to formally beginning their actual modules.

Architecture and Construction

Architecture and Construction surround us in our everyday life. The following is taken directly from the student's design module.

The M2E consulting firm is competing for a contract to design and build an innovative portable shelter for a premiere entertainment company. They will combine all of the knowledge and skills learned from their foundational experience including teamwork and technical writing and combine it with their specific research on structural components to secure the contract. Students will then take their design and create a model to demonstrate compliance with the design criteria.

Cluster Objectives

This Architecture and Construction module is classified under the Architecture & Construction Career Cluster. Individuals that work in the Architecture & Construction Career Cluster demonstrate the following skills and knowledge:

1. Use vocabulary, symbols and formulas common to architecture and construction.
2. Use architecture and construction skills to create and manage a project.
3. Comply with regulations and applicable codes to establish and manage a legal and safe workplace.
4. Evaluate the nature and scope of the Architecture & Construction Career Cluster and the role of architecture and construction in society and the economy.
5. Describe the roles, responsibilities and relationships found in the architecture and construction trades and professions, including labor/management relationships.
6. Read, interpret and use technical drawings, documents and specifications to plan a project.
7. Describe career opportunities and means to achieve those opportunities in each of the Architecture & Construction Career Pathways.

Career Pathway

There are hundreds of related careers in the Architecture & Construction Career Cluster, some more similar than others. By classifying these similar careers into narrower categories called pathways, it helps individuals look at a range of options when it comes to employment in an area with similar skills and knowledge. Although this system of classifying careers into clusters and pathways is helpful in navigating career options, it is not the only way. This module is more specifically aligned with the Design/Pre-construction Career Pathway. Individuals in this pathway share a set of skills and knowledge that expands on the skills and knowledge needed in the Architecture & Construction Career Cluster. Individuals in the Design/Pre-construction Career Pathway demonstrate the following skills and knowledge:

1. Justify design solutions through the use of research documentation and analysis of data.
2. Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.
3. Describe the requirements of the integral systems that impact the design of buildings.
4. Apply building codes, laws and rules in the project design.
5. Identify the diversity of needs, values and social patterns in project design, including accessibility standards.
6. Apply the techniques and skills of modern drafting, design, engineering and construction to projects.
7. Employ appropriate representational media to communicate concepts and project design.
8. Apply standards, applications and restrictions pertaining to the selection and use of construction materials, components and assemblies in the project design.

Real World Activities: M2E Company

Designing and Testing a Truss - A popular band will be the musical headliner for this summer's FestCo events. As you already know, M2E has been asked to design the main lighting truss for the concert! Using the design and testing techniques that you have learned in the previous tutorial and using the new Truss Design Tutorial, design the band's new truss. They are counting on you, as this truss will be hanging 40 feet high, right over their heads!

Soil Sampling and Analysis – The FestCo design team at M2E needs to perform a soil evaluation for the sites of this summer's FestCo events. Lucky for you, one of the festival locations is near your school!

While earthquakes are rare in near all of the event sites, it is always necessary to do a soil evaluation before building. In this project, you and your team will prepare a soil evaluation presentation using the samples obtained from the soil near your school.

Water Slide Design

In addition to the festivities at this summer's FestCo events, the firm has decided to add a water slide attraction to the festival. David, the company's CEO, insists that the slide be a dramatic addition to the events.

Your team has already tested the soil composition to ensure safe slide construction conditions at every festival site. In this project, you will design a structurally sound, reconstructable body slide to meet David's design needs. Complete this assignment working in pairs. You and your partner have three class sessions to complete this task.

Designing a Portable Shelter

The portable shelter design process is now in your hands. David has entrusted you to design a shelter to replace the need for tent rentals at his traveling summer festivals. His shelter specifications are extremely specific and M2E is counting on your expertise to assist in their design process. Use what you've learned throughout the Foundations and Applications portions of the CAREERplus2 Program to develop the best possible portable shelter design.

Case Studies

A case study is a written account of an engineering activity as it was actually carried out. It's a true story, A narrative, with detailed backgrounds. Take a look at both the "Racing the Wind" case study and the "Hyatt Regency Walkway Collapse."

Students will select one of the case studies and submit their answers to these questions.

- Make a connection between the Architecture and Construction portion of the CAREERplus2: Application program and this case study. How did this story relate to this portion of the program? Utilize vocabulary you learned through the course of the program to explain your response.
- Did the engineer in this story showcase ethical actions? Why?
- How has this case study changed your ways of thinking about the Architecture and Construction portion of this program?

Career Planning

In this module you have now experienced many of the tasks associated with the Engineering and Technology Career Pathway. In addition, you have made connections to some of the related careers in the STEM Career Cluster. There are two goals that we want to help you achieve by completing this module. The first is to help you identify and develop your skills and knowledge in the career cluster. The second is to give you a better idea of careers that you can pursue and a means to achieve those opportunities.

Select two of the careers listed and follow the links to My Next Move to research the next steps in pursuing each.

- Soil Scientists
- Architects
- Civil Engineers
- Construction Manager
- Surveyors
- Materials Engineers
- Mechanical Engineers
- Geologists

Alternative Energy & Environment

Alternative Energy and Environment addresses some of the more compelling challenges of our global society. The M2E consulting firm is competing for a contract in Gambia (West Africa). Students must combine all of the knowledge and skills learned from their foundational experience and combine it with their specific research to design and build a solar cooker that meets the design criteria. Students will then collect data and report their findings to secure the contract.

Cluster Objectives

This Alternative Energy & Environment Module is classified under the STEM Career Cluster. Individuals that work in the STEM Career Cluster demonstrate the following skills and knowledge:

1. Apply engineering skills in a project that requires project management, process control and quality assurance.
2. Use technology to acquire, manipulate, analyze and report data.

3. Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.
4. Understand the nature and scope of the Science, Technology, Engineering & Mathematics Career Cluster and the role of STEM in society and the economy.
5. Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways.
6. Demonstrate technical skills needed in a chosen STEM field.

Career Pathway

There are hundreds of related careers in the STEM Career Cluster, some more similar than others. By classifying these similar careers into narrower categories called pathways, it helps individuals look at a range of options when it comes to employment in an area with similar skills and knowledge. Although this system of classifying careers into clusters and pathways is helpful in navigating career options, it is not the only way. This module is more specifically aligned with the Engineering and Technology Career Pathway. Individuals in this pathway share a set of skills and knowledge that expands on the skills and knowledge needed in the STEM Career Cluster. Individuals in the Engineering and Technology Career Pathway demonstrate the following skills and knowledge:

1. Use STEM concepts and processes to solve problems involving design and/or production.
2. Display and communicate STEM information.
3. Apply processes and concepts for the use of technological tools in STEM.
4. Apply the elements of the design process.
5. Apply the knowledge learned in STEM to solve problems.
6. Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.

Real World Activities: M2E Company

Parabola Focal Point

This is M2E's first solar oven design project. The team recognizes that a parabolic shape will serve as the heat collecting element in their solar oven design.

To begin the project, you and your M2E team members will experiment with various parabolic shapes. This lesson will further your understanding of the various shape options for your solar oven design.

Design a Parabolic Dish

Engineers sometimes use complex tools to design very accurate products and tools for industry. However, all engineers look for ways to do the same job that “elegantly simple.”

In this project, you and your M2E team members will design your parabolic dish using two methods, one simple and one complex. Your team will experiment with a variety of parabolas in order to best decide which one will meet the design criteria in the next project. Create two or three viable design options using both programs.

Solar Oven Construction

You and your team members will continue designing a solar oven for people to use in a remote village where there is no electricity or easily available resources for building a fire. Remember to keep their overall intentions in mind: they hope to produce enough heat to boil water with the oven.

During this project you will further devise a plan for building your solar oven. Your teams should have two or three viable designs from your Excel and SolidWorks designs. Your testing should have given you some further insights into which design was the best.

Solar Oven Completion, Testing and Presentation

The day has finally come! Your hard work is paying off and it's time to construct the solar oven you and your team at M2E have been working on! The Gambian Consulate is counting on you to deliver an effective solar oven for the people of their country.

In this project, your team will complete work on building the solar oven. You have four days to complete this part of the project. Once you have the dish shape built you will line the dish with heavy cardstock and reflective mylar sticky-back paper.

Case Studies

A case study is documentation of an engineering activity or process where information and background are given in great detail about the research and development of a project over time. In this activity, you and your partner will choose from one of the two case studies provided to read and reflect on and then answer critical-thinking questions.

Ivanpah Solar Project - How Solar Ovens are Changing Lives in the Dominican Republic

Select one of the case studies and submit your answers to these questions.

- If solar parabolic troughs can provide so many benefits, why aren't they more prevalent through the United States?
- Aside from the benefits mentioned in the article, what are some other advantages of these solar power projects to both humans and the environment?
- Do you feel the government is doing enough to promote solar energy?

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Select two of the careers listed and follow the links to My Next Move to research the next steps in pursuing each.

- Computer Engineers
- Industrial Engineers
- Civil Engineers

- Electrical Engineers
- Environmental Engineers
- Mechanical Engineers

Robotics

From science fiction to factory floors, robots are everywhere. The M2E consulting firm is pursuing a government contract for a specialized robot. They will combine all of the knowledge and skills learned from their foundational experience emphasizing problem-solving and combine it with their acquired programming skills to design and build a robot that can stand up to government specifications. Students must face the pressure of a performance based challenge to win the contract.

Cluster Objectives

This Robotics Module is classified under the STEM Career Cluster. Individuals that work in the STEM Career Cluster demonstrate the following skills and knowledge:

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2. Use technology to acquire, manipulate, analyze and report data.
3. Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.
4. Understand the nature and scope of the Science, Technology, Engineering & Mathematics Career Cluster and the role of STEM in society and the economy.
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3. Apply processes and concepts for the use of technological tools in STEM.
4. Apply the elements of the design process.
5. Apply the knowledge learned in STEM to solve problems.
6. Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.

Real World Activities: M2E Company

Robot Design

In this project, your group will split into teams. The teams will use Solidworks to design a robot chassis based on step by step instructions. The chassis shall use component and assembly pieces from the Solidworks library. You will need to draw the metal framework of the chassis with all cross rails and fasteners according to the specifications.

Robot Assembly and Testing

Now that the basic chassis is drawn, your team can begin to assemble the chassis using the VEX components. In the first part of this project, you and your team will build the robot chassis and drivetrain. You will be adding the retrieval gripper and components later. In the second part of this project, you will program and test drive the robot chassis.

Pneumatic System-Assembly and Testing

In this project, you and your team will need to construct and test a pneumatic system for the M3 Robot. The pneumatic system will be used to launch the transmitter orbs. The pneumatic components are included in the VEX kit of parts.

Robot

NASA has contracted M2E to develop a Moon Mineralogy (M3) Robot. In this project, you and the M2E team will use what you've learned throughout the course of this module to develop a robot that meets NASA's criteria for gathering crucial data on lunar environments. The robot must be capable of driving to remote areas and pneumatically launching wooden balls (Transmitter Orbs

Case Study

A case study is a written account of an engineering activity as it was actually carried out. It's a true story, a narrative, with detailed backgrounds. Take a look at Gibson's Robotic Guitar Case Study.

Submit your answers to this question.

- As described in the case study, the robot guitar is revolutionary. Describe two other products that have recently been revolutionized by robotics.

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Select two of the careers listed and follow the links to My Next Move to research the next steps in pursuing each.

- Materials Engineers

- Robotics Engineer
- Electrical Engineers
- Mechanical Engineers

Manufacturing and Materials

Manufacturing and Materials provides students with the opportunity to gain an understanding of how technicians and engineers use 3-D design software to build components and assemblies. The M2E consulting firm is trying to break into a new market by designing and manufacturing a new custom guitar for the band Convergence. They will combine all of the knowledge and skills learned from their foundational experience including 3D modeling and combine it with their specific research on guitar components to design a custom body, headstock, and tuners to secure the contract. Students will then take their designs through the manufacturing process to develop a prototype for their presentation.

Cluster Objectives

This Manufacturing & Materials module is classified under the Architecture & Construction Career Cluster. Individuals that work in the Architecture & Construction Career Cluster demonstrate the following skills and knowledge:

1. Use vocabulary, symbols and formulas common to architecture and construction.
2. Use architecture and construction skills to create and manage a project.
3. Comply with regulations and applicable codes to establish and manage a legal and safe workplace.
4. Evaluate the nature and scope of the Architecture & Construction Career Cluster and the role of architecture and construction in society and the economy.
5. Describe the roles, responsibilities and relationships found in the architecture and construction trades and professions, including labor/management relationships.
6. Read, interpret and use technical drawings, documents and specifications to plan a project.
7. Describe career opportunities and means to achieve those opportunities in each of the Architecture & Construction Career Pathways.

Career Pathway

There are hundreds of related careers in the Architecture & Construction Career Cluster, some more similar than others. By classifying these similar careers into narrower categories called pathways, it helps individuals look at a range of options when it comes to employment in an area with similar skills and knowledge. Although this system of classifying careers into clusters and pathways is helpful in navigating career options, it is not the only way. This module is more specifically aligned with the Production Career Pathway. Individuals in this pathway share a set of skills and knowledge that expands on the skills and knowledge needed in the Architecture & Construction Career Cluster. Individuals in the Production Career Pathway demonstrate the following skills and knowledge:

1. Diagnose production process problems and take corrective action to meet production quality standards.
2. Manage safe and healthy production working conditions and environmental risks.
3. Make continuous improvement recommendations based on results of production process audits and inspections.
4. Coordinate work teams when producing products to enhance production process and performance.
5. Demonstrate the safe use of manufacturing equipment.

Real World Activities: M2E Company

Designing a Guitar Headstock

Designing an electric guitar involves cooperation between materials engineers, electrical engineers, machine technicians, assemblers, finishers and of course musicians. In this project, you will use SolidWorks to design and develop a guitar headstock for a 6-string electric guitar for the band "Convergence". You will have four class periods to complete this task.

Designing a Guitar Tuner

It is necessary to have a theoretical plan to build most objects. The designer or manufacturer must theorize, solve complex mathematical problems, use formulas, and create conceptual drawings to know and understand every detail of the product to be able to build the item to reasonable specifications.

The Convergence Guitar team at M2E has completed the Headstock Design and has moved on to the tuner design. In this project, you and the M2E team will design a signature guitar tuner for a 6-string electric guitar for the band "Convergence." You will work in teams of two and will have three class periods to complete the project.

Designing a Guitar Body

After completing the headstock and tuner designs, the next step in the Convergence Guitar design process is developing the guitar's body. In this project, you and the M2E team will use SolidWorks to design and develop a signature guitar body for a 6-string electric guitar for the band.

Designing a Custom Guitar

The guitar design process is now in your hands. In this project, you and the M2E team will use what you've learned throughout the course of this module to develop a new and improved custom electric guitar design that meets the band Convergence specifications for improved sustain, tone, resonance, playability and performance. They are counting on you to deliver a high-quality guitar - be sure you don't disappoint! You will also machine a 1/2 scale model using Computer Aided Manufacturing (CAM). You will work in teams of two and will have four class periods to complete this task.

Case Study

A case study is a written account of an engineering activity as it was actually carried out. It's a true story, a narrative, with detailed backgrounds. Take a look at both the Gibson's Tech Trek Case Study and the The Coughing Robot Case Study and go to the video and internet links in each.

Submit your answers to these questions.

- Think of 5 manufactured items that involve intricate detail cutting during production. Could each of these utilize a CNC program to increase productivity like the one you saw in the Warsaw Machinery videos?
- Engineers designed a viable solution to the clogged throat problem; however, an additional sensor was deemed necessary. Discuss several current technologies that exist that perhaps create more of a problem than a solution by over-complicating the situation.

Career Planning

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Select two of the careers listed and follow the links to My Next Move to research the next steps in pursuing each.

- Materials Engineers
- Industrial Engineers
- Electrical Engineers
- Mechanical Engineers
- Designer
- Electronics Engineering Technician

Text(s): Title: (no actual textbook required - online, cloud-based learning)

Edition: _____ Publication Date: _____

Publisher: _____ Author (s): _____

URL Resource(s) _____

Usage

Primary Text

Read in entirety or near entirety

Pre-Requisites

Algebra 1, Foundations of Technology & Engineering

Co-Requisites

Supplemental Instructional Material: *Please Describe. If using online text or non-standard material, please provide the title of the material or webpage and the URL link.*

Online, cloud-based learning management system

Instructional Methods and/or Strategies:

Minimal "lecture." Lessons are on-line and formative assessments occur throughout the material.

Assessment Methods and/or Tools:

Each learning episode involves mastery checkpoints. Major checkpoint tests occur twice/unit.

Activities: *(if applicable)*

Each unit is hands-on, project based learning. Final project (report and presentation).

Certificate: *(if applicable)*

SolidWorks test may be taken if student desires.