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save you TIME AND MONEY!

**Iowa Central Community College**  
**Industrial Technology Department**



**Course Syllabus**

Course Name: Introduction to Engineering Design	
Course Number: EGT-400	
Class Location and Time:	
Room: AST-121	Day: TR Time: 9:40 am -11:50 am
Room:	Day: Time:
Course Start Date: 8/30/2012	Course End Date: 12/13/2012
Instructor: Carl Gross	Office Location: SC-301A
E-mail Address: gross_c@iowacentral.edu	Office Hours:
Phone: (515) 574-1227, x or 800 362-2793, x 1227	Days: MWF Times: 9:10 am-10:10 am
	Days: TR Times: 1:10 pm – 2:10 pm
	Days: Times:
Final Exam: Day: Tuesday Date: 12/13/2012 Time: 9:40 am -11:10 am	
Departmental Assistance: For help with course selection, class registration, transfer information, and other academic assistance, please contact the department associate, Phyllis Minnihan in AST 117 at 515-574-1903 or by email to <a href="mailto:Minnihan@iowacentral.edu">Minnihan@iowacentral.edu</a>	

1. Total Semester Hour Credit: 3
2. Total Contact Hours per Semester: Lecture: 36 Lab: 36 Clinical:
3. Catalog Description:
 

This course is an introduction to the elements of Engineering Design. Students will learn the history of design, design process, sketching and visualization, geometric relationships, and modeling. Elements of manufacturing production, marketing, analysis, and quality control will also be studied. Students will learn presentation techniques and develop a portfolio.
4. Prerequisites and/or Co-requisites: None
5. Textbook Required: Parametric Modeling with Autodesk Inventor, Randy H. Shih, SDC Publications, 2012 ISBN: 9781585035588
6. Supplemental Materials Required:
  - Engineer Notebook – may be any notebook with permanent pages
  - USB flash drive – (Does not need to be used for this course only.)
7. College Procedures:
  - Children in the Classroom:

- Students are not allowed to bring children into the classrooms, labs, shops, or hallways during class times.
- **Electronic Devices in the Classroom:**
  - Cell phones, pagers, timers and similar devices are not to be operational during classroom, lab, and clinical times.
- **Inclement Weather Statement:**
  - The final decision to attend college classes can only be made by the individual based on their specific extenuating circumstances that may make it hazardous for them to travel.
- **Academic Accommodations:**
  - Any student who feels they may need academic accommodations should contact the Special Populations Coordinator early on in the semester. The Coordinator will verify documentation and coordinate appropriate and reasonable accommodations. Students must obtain a new accommodation notification each semester.
    - For information contact:
    - Heather Lundberg
    - Special Populations Coordinator
    - Student Resource Center/Library
    - 515-574-1045

#### 8. Additional Course Information:

- Attendance
  - Attendance is required for success. Please be sure to attend class regularly. Refer to your student handbook for college attendance policy.
- Late Work
  - A regular homework assignment or quiz is **NOT** accepted late for **any reason**.
  - A progress check on a project in the engineering notebook is counted as a regular homework assignment.
  - A project assignment that takes a number of days to complete will be accepted late with penalty. Penalty: 10% per day deduction in total score.
- Make-up Work
  - Arrangements must be made with the instructor **prior to due date** if possible.
    - At minimum an e-mail or Facebook message must be received by the end of the day to be eligible for make-up work.
  - When available, make-up work will likely be different from in-class versions.
  - Make-up work will be evaluated on a case-by-case basis.
  - Missed presentations can't be made up unless arrangements are made **at the time the presentation is assigned**.
- Extra Credit

- Not available.
- Quiz / Homework
  - Missed homework can't be made up because it is graded as attempted or not.
  - Quizzes can be made up by taking an alternate version. The alternate is due no later than the due date of the next assigned quiz unless otherwise stated.
    - The highest score from either the original or the alternate will apply to your grade.

*9. Grading Policy:*

Letter Grade Minimum Percent	
A	>90
B	>80
C	>70
D	>60
F	<60

Grade Weighting	
Homework	30
Quiz	10
Notebook	20
Cube Project	10
Product Project	10
Final Project	10
Final Exam	10

10. Course (Student) Outcomes:

- Students will demonstrate the ability to use critical thinking skills
- Students will demonstrate the ability to communicate effectively.
- Students will demonstrate personal responsibility.

11. Learning Strategies (Instructional Methods):

- Lecture, hands-on lab exercises, videotapes, guest speakers, team exercises, unit problems, worksheets, computer-based problem solving.

12. Unit (Competencies) Outcomes:

**Project Lead The Way®**  
**“Introduction to Engineering Design”**

<b>Project Lead The Way®</b>		
Perf. Num.	Performance Objective Statement	
	<b>Unit 1</b>	
	<b>Overview</b>	
	Section 1.1	
	History of Design	
1	Students will develop an appreciation of how the history of art has influenced innovations in the field of engineering, and explain the impact of artistic expression as it relates to consumer products.	
2	Students will research how artistic period and style have influenced product and architectural design.	
3	Students will explore the design concept of form and function and explain its use in product design.	
4	Students will explore the evolution of technology and be able to identify engineering achievements through history.	
5	Students will research the chronological development and accelerating rate of change that innovations in tools and materials have brought about over time as it relates to a given consumer product.	
6	Students will review the history of measurement tools and identify two innovations that have led to improved functionality of that tool.	
	Section 1.2	
	Professional Organizations	
1	Students will explore a given professional organization and summarize in a short PowerPoint presentation the range of services provided by the organization.	
	Section 1.3	
	Career Opportunities	
1	Students will identify career opportunities in design engineering and explain their job functions.	
	Section 1.4	
	Education Requirements	
1	Students will explore career opportunities in a given engineering field and list the educational requirements for each profession.	

	<b>Unit 2</b> <b>Introduction To Design</b>	
	Section 2.1 Design Process	
1	Students will list the seven steps of the design process and explain the activities that occur during each phase.	
2	Students will assess the value of working as a team and understand the benefits of collaboration.	
3	Students will realize the importance of focusing on detail when executing the design process.	
4	Students will apply the steps of the design process to solve a variety of design problems.	
	Section 2.2 Principles and Elements of Design	
1	Students will investigate the principles and elements of design and demonstrate their use in the design process incorporating them in design solutions.	
2	Students will identify the use of the principles and elements of design in various products, print media, and art forms.	
3	Students will express their understanding of the principles and elements of design by incorporating them in design solutions.	
4	Students will collect and display examples of the application of the principles and elements of design utilized in products, print media, and art forms.	
	<b>Unit 3</b> <b>Student Portfolio Development</b>	
	Section 3.1 Student Portfolio Development	
1	Students will identify the proper elements of a fully developed portfolio.	
2	Students will identify and discuss the ethical issues surrounding portfolio artifacts.	
3	Students will compare and contrast defined elements of a good portfolio specified in the PowerPoint presentation to the sample provided in the PLTW . Design Resource Guide.	
4	Students will develop a portfolio to organize and display evidence of their work.	
	<b>Unit 4</b> <b>Sketching and Visualization</b>	
	Section 4.1 Sketching Techniques	
1	Students will integrate proper sketching techniques and styles in the creation of sketches.	
2	Students will demonstrate the ability to produce two-dimensional geometric figures.	
	Section 4.2 Pictorial Sketching	
1	Students will select and produce the appropriate pictorial style to best communicate solutions in the design process.	
2	Students will formulate pictorial sketches to develop ideas, solve problems, and understand relationships during the design process.	
3	Students will create sketches utilizing both the additive and subtractive methods to assess underlying geometric and perceptual principles.	
4	The student will select a sketching method that is efficient in its use of color, form, and symbols representing abstract data.	

5	Students will augment pictorial sketches with shading to improve communication.	
	Section 4.3 Annotated Sketches	
1	Students will evaluate and select the necessary views to graphically communicate design solutions.	
2	Students will interpret annotated sketches in the design analysis process.	
3	Students will integrate annotated sketches in presentations, portfolio, and documentation process.	
4	Students will develop properly annotated sketches to accurately convey data in a design solution.	
	<b>Unit 5</b> <b>Geometric Relationships</b>	
	Section 5.1 Forms and Shapes	
1	Students will define and contrast points, lines and line segments.	
2	Students will identify major geometric shapes (isosceles triangle, right triangle, scalene triangle, rectangles, squares, rhombus, trapezoid, pentagon, hexagon, and octagon).	
3	Using a compass, ruler and triangle students will construct various geometric shapes.	
4	Students will define the elements and types of angles.	
5	Using a compass, ruler and triangle students will construct and bisect various types of angles.	
6	Students will define terminology associated with arcs and circles.	
7	Using a compass, ruler and triangle students will construct arcs, circles and ellipses.	
	Section 5.2 Geometric Constraints	
1	Students will distinguish and define geometric constraints.	
2	Students will identify the following geometric constraints in given three-dimensional models: horizontal, vertical, parallel, perpendicular, tangent, concentric, collinear, coincident, and equal.	
	Section 5.3 Coordinate Systems	
1	Students will apply the right hand rule to identify the X, Y, and Z axes of the Cartesian Coordinate System.	
2	Students will apply a combination of absolute, relative, and polar coordinates to construct a three-dimensional model.	
3	Students will define the origin planes in the Cartesian Coordinate System.	
4	Students will identify the origin and planar orientations of each side of a three-dimensional model.	
	<b>Unit 6</b> <b>Modeling</b>	
	Section 6.1 Conceptual Modeling	
1	Students will experience the creative thinking process.	
2	Students will recognize the difference between vertical and lateral thinking.	
3	Students will categorize and select a solution to a problem.	
4	Students will communicate their idea through written and verbal formats.	

	Section 6.2 Graphical Modeling	
1	Students will identify the different graphical method of data representation.	
2	Students will select the appropriate graphical format to a problem.	
3	Students will analyze and develop graphical representation of given data.	
	Section 6.3 Physical Modeling	
1	Students will have an understanding of the different physical modeling techniques.	
2	Students will present a model with its correct proportions.	
3	Students will select the appropriate modeling materials to complete a three-dimensional model.	
	Section 6.4 Mathematical Modeling	
1	Students will evaluate a problem using mathematical formulae.	
2	Student will analyze a solution to a problem using the correct format of analysis.	
	Section 6.5 Computer Modeling	
1	Students will interpret a sketch and generate a model using a computer and a CAD software package.	
2	Students will explain the difference between parametric and adaptive designs and be able to specify their uses.	
3	Students will draw a two-dimensional sketch using a CAD package.	
4	Students will apply geometrical and dimensional constraints to a sketch.	
5	Students will demonstrate the ability to generate a three-dimensional model.	
6	Students will understand and demonstrate the use of work features and how they are applied while constructing a solid model.	
7	Students will recognize the use and need of work planes, axes, and points in the development of a computer model.	
8	Students will demonstrate the ability to modify a sketch or feature of a model.	
	<b>Unit 7</b> <b>Assembly Modeling</b>	
	Section 7.1 Adding Components	
1	Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.	
2	Students will understand and apply the base component effectively in the assembly environment.	
3	Students will place and create components in the assembly modeling environment.	
4	Students will create circular and rectangular patterns of components within an assembly model.	
5	Students will replace components with modified external parts.	
6	Students will perform part manipulation during the creation of an assembly model.	
7	Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.	
	Section 7.2 Assembly Constraints	

1	Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.	
2	Students will perform part manipulation during the creation of an assembly model.	
3	Students will apply assembly constraints to successfully construct a multi-part object.	
	Section 7.3 Part Library	
1	Students will utilize part libraries effectively during the assembly modeling process.	
2	Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.	
	Section 7.4 Sub-Assemblies	
1	Students will employ sub-assemblies during the production of assemblies.	
2	Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.	
	Section 7.5 Driving Constraints	
1	Students will understand and apply drive constraints to simulate the motion of parts in assemblies.	
2	Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.	
	Section 7.6 Adaptive Design	
1	Students will explore, understand, and apply adaptive design concepts during the development of sketches, features, parts, and assemblies.	
2	Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.	
	<b>Unit 8</b> <b>Modeling Analysis and Verification</b>	
	Section 8.1 Mass Properties	
1	Students will demonstrate how to extract mass properties data from their solid models.	
2	Students will evaluate the accuracy of mass properties calculations.	
3	Students will describe how analysis data can be used to update parametric models.	
4	Students will list and explain the various mass property calculations, such as, volume, density, mass, surface area, centroid, moment of inertia, products of inertia, radii of gyration, principal axes, and principal moments, and how they are used to evaluate a parametric model.	
	Section 8.2 Tolerancing	
1	Students will interpret and use correct tolerancing techniques when dimensioning solid models.	
2	Students will understand and solve tolerance problems, including limits and fits.	
3	Students will understand the differences between clearance fit, interference fit, and allowance.	
	<b>Unit 9</b> <b>Model Documentation</b>	

	Section 9.1 Working Drawings	
1	Students will select the appropriate sheet size and title block for creating a drawing layout.	
2	Students will translate a three-dimensional drawing or model into corresponding orthographic drawing views.	
3	Students will describe the purpose, and/or application, of the following drawing views: isometric view, section view, auxiliary view, and detail view.	
4	Students will generate an isometric view from orthographic drawing views.	
5	Students will determine the correct application for the various section views required to illustrate an object's internal detail.	
6	Students will describe the purpose and application of hatch marks and a cutting plane line, as used in a section view.	
7	Students will create the appropriate section view for a specified application.	
8	Students will create a detail view that corresponds to the appropriate orthographic drawing view.	
9	Students will create an auxiliary view to show the detail on an inclined surface of a drawing object.	
	Section 9.2 Dimensioning	
1	Students will list the common dimensioning standards.	
2	Students will identify and demonstrate the use of common dimensioning systems.	
3	Students will describe the characteristics and demonstrate the use of unidirectional and aligned dimensioning.	
4	Students will differentiate the use of and demonstrate an understanding of size and location dimensions by applying these types of dimensions to annotated sketches and drawings.	
5	Students will demonstrate appropriate dimensioning rules and practices.	
6	Students will set up and integrate the use of a customized common dimensioning standard.	
7	Students will identify and demonstrate the use of dimensioning practices on section, auxiliary, and assembly models.	
8	Students will define and demonstrate an understanding of tolerancing, and solve tolerance problems.	
	Section 9.3 Annotation	
1	Students will apply appropriate annotations on sketches and drawings.	
2	Students will understand and formulate general and proprietary specifications to further communicate information relating to product design.	
	<b>Unit 10 Presentation</b>	
	Section 10.1 Communications Techniques	
1	Students will demonstrate the following communication techniques: voice variation, eye contact, posture, attire, practice and preparation, and projecting confidence.	
	Section 10.2 Presentation	
1	Students will have an understanding of various forms of visual aids and when to use them in a presentation.	

2	Considering the audience and level of formality, students will select the most appropriate type of visual aid for a presentation.	
3	Considering the audience and level of formality, students will select the most appropriate type of written documentation for a presentation.	
4	Students will identify the elements of the various forms of written documentation.	
	<b>Unit 11</b>	
	<b>Production</b>	
	Section 11.1	
	Manufacturing Design Analysis	
1	Students will recognize the need to involve all of the manufacturing team members in the decision making process of designing a product.	
2	Students will be able to categorize manufacturing specifications and constraints needed to produce a product.	
3	Students will be able to evaluate material characteristics for manufacturing a specific product and identify the correct manufacturing process needed to produce that product.	

	Section 11.2 Process Planning	
1	Students will evaluate and apply the correct machine process.	
2	Students will recognize the need to limit the number of processes used to manufacture a product.	
3	Students will develop an understanding of process routing.	
	Section 11.3 Design for Automated Manufacturing	
1	Students will distinguish the differences between CNC, FMS, and CIM.	
	Section 11.4 Materials, Procurement, Handling & Cost Analysis	
1	Students will explain the need for a company to minimize material handling by procurement of materials in a timely fashion. Students should explain the JIT process.	
2	Students will identify the need to perform a cost analysis of a product.	
	Section 11.5 Quality Control	
1	Students will interpret data, which has been statically analyzed, to ensure product quality.	
	Section 11.6 Manpower and Facility Requirements	
1	Students will identify the need to evaluate the areas of manpower and facility requirements.	
	Section 11.7 Packaging	
1	Students will recognize the need to protect a product for shipping.	
2	Students will analyze aesthetic requirements to enhance packaging for the consumer.	
	<b>Unit 12 Marketing</b>	
	Section 12.1 Product Analysis	
1	Students will define, explain, and demonstrate an understanding of common vocabulary words used in association with product cost analysis.	
2	Students will formulate a product cost analysis for a given product.	
	Section 12.2 Packaging Requirements	
1	Students will demonstrate an understanding of packaging design requirements.	
2	Students will design a package for a given product.	