Introduction to Engineering Design (EGR–131)

Block 2 – 2019

General Information:

Instructor: Brian Johns

Office: West Science 105

Phone: (319) 895-4368

Email: bjohns@cornellcollege.edu

Office Hours: 11:00am – 12:00pm MWF, also by appointment

Course Meeting Times:

M&W 9:00 am – 11:00 am in West Science 106

1:00 pm – 3:00 pm in in Cole Library Lab 212

T&Th* 12:15 pm – 1:05 pm in West Science 106

1:05 pm – 3:00 pm in in Cole Library Lab 212

F 1:00 pm – 3:00 pm in in Cole Library Lab 212

*Note: We will have additional final project meetings the morning of October 3.

Required Textbook:

Toogood R. Creo Parametric 6.0 Tutorial. SDC Publications; 2019.
ISBN: 978-1-63057-291-4

Reference Textbooks (Not required):

Dym CL, Little P. Engineering Design, A Project Based Introduction. Wiley; 2008.
Haik Y, Shahin T. Engineering Design Process. Cengage Learning; 2010.
Leake J. Engineering Design Graphics, Sketching, Modeling, and Visualization. Wiley; 2012.
Lidwell W, Holden K, Butler J. Universal Principles of Design, Revised and Updated, 125 Ways to Enhance Usability, Influence Perception, Increase Appeal, Make Better Design Decisions, and Teach Through Design. Rockport Pub; 2010.
Salvendy G. Handbook of Human Factors and Ergonomics. John Wiley & Sons; 2012.
Schmidt L, Dieter G. Engineering Design. McGraw-Hill Education; 2012.

Other Required Course Materials:

Engineering Computation Pad
Mechanical Pencils
3D Printing Material (Instructor will explain details)
Scientific Calculator (or Graphing Calculator)

Course Description & Objectives:

Course Description:

Introduction to Engineering Design is an entry-level course for students interested in engineering and design. The course will teach students the engineering design process, 3D modeling, design analysis, teamwork, and communication. The course emphasizes hands-on design and problem-based learning.

Course Objectives:

The course is designed to support the *Educational Priorities and Outcomes* of Cornell College. This course primarily emphasizes *knowledge*, *reasoning*, and *communication*, with supplementary importance in *inquiry* and *vocation*. The following show the course objectives and their corresponding educational priority.

- Analyze engineering designs and decisions based on their environmental, ethical, ergonomic, and economic impact. (Knowledge, Reasoning)
- Gain fundamental knowledge of 3D design, model assembly, and engineering drawings that will translate to the engineering industry. (Knowledge, Vocation)
- Synthesize new designs and improve existing designs using creativity, logical thinking, quantitative analysis, and research. (Inquiry, Reasoning)
- Develop skills to effectively work in a design team, emulating common design situations encountered in the engineering profession. (Communication, Vocation)
- Clearly communicate, in written and verbal form, the process, constraints, and decisions leading to a final design. (Communication)

Performance Indicators:

2a	Convert open-ended problems to design specifications.
2b	Construct a prototype which meets design specifications
2c	Design a product (system, component, or process) that solves a real-world problem.
2d	Demonstrates ability to build and assemble complex devices.
2e	Construct a bill of materials for a prototype which meets specifications.
3a	Written work and /or oral presentations are well organized
3b	Oral presentations use effective supporting materials
3c	Written work contains clear, detailed descriptions and is logically cohesive
4a	**Analyze the ethical implications of an engineering problem**
4b	**Proposes a solution or critiques a proposed solution to an engineering problem which impacts the world.**
5a	Adopt leadership roles to accomplish team objectives.
5b	Perform delegated tasks and actively participate in group meetings.
5c	Encourage the participation of others.
5d	Respond objectively to conflict within a team.

5e	Foster constructive climate within and between teams.
7a	**Independently finds and evaluate engineering resources.**

Course Outline:

Class sessions will primarily consist of exploring and gaining knowledge in new topics. These topics will be taught by class lecture, readings, discussion, hands-on activities, and/or small projects.

Class Topics (subject to change):

- Engineering Design Process
- Thinking, Ideation, & Sketching
- Design Planning/Evaluation Tools
- Design Constraints & Optimization
- Engineering Responsibility & Ethics
- Aesthetics of Design
- Reverse Engineering & Benchmarking
- Rapid Prototyping
- Human Factors & Ergonomics
- Engineering Drawings/GD&T
- Design for Manufacturing

Lab sessions will emphasize hands-on design. These sessions will be dedicated to learning CAD software, evaluating and improving existing products, and synthesizing and testing original designs.

Lab Topics (subject to change):

- User Interface, View Controls, & Model Structure
- Sketches, Extrudes, & Cuts
- Holes, Chamfers, & Rounds
- Revolved Protrusions
- Mirroring Entities
- Datum Planes & Sketcher Tools
- Patterns and Copies
- Engineering Drawings
- Assembly Fundamentals & Operations
- Sweeps & Blends

Grading

Grading Criteria:

Component	Percentage
Attendance	10%
Midterm Exam	20%
Homework/Class Activities	20%
Final Project	30%
Final Exam	20%

Grading Scale:

A	95-100
A-	90-94
B+	87-89
B	84-86
B-	80-83
C+	77-79

C	74-76
C-	70-73
D+	67-69
D	64-66
D-	60-63
F	<60

Course Requirements & Policies:

Attendance:

As a student you are required to attend all sessions of class. Please inform me of any planned absences at the beginning of the block so we can make arrangements. Attendance will be taken at the beginning of each class session (morning and afternoon). Points will be deducted after the 2nd unexcused absence.

Exams:

There will be two (2) exams during the course. The first exam will test students' knowledge of 3D modeling by requiring them to create a 3D model from a 2D engineering drawing. The second exam will be a comprehensive exam, covering both classroom topics and CAD modeling.

Projects:

There will be several small projects throughout the duration of the course and one larger final project. The final project will require students work in small teams. The team will design a product and use rapid prototyping technology to develop a prototype. Furthermore, the group will prepare a report documenting their design process and deliver a short presentation showcasing their design.

Homework:

Expect to receive homework every day. Homework is due at the beginning of class. No late homework will be accepted. The lowest homework grade will be dropped at the end of the course.

Academic Honesty Policy:

Cornell College expects all members of the Cornell community to act with academic integrity. An important aspect of academic integrity is respecting the work of others. A student is expected to explicitly acknowledge ideas, claims, observations, or data of others, unless generally known. When a piece of work is submitted for credit, a student is asserting that the submission is her or his work unless there is a citation of a specific source. If there is no appropriate acknowledgement of sources, whether intended or not, this may constitute a violation of the College's requirement for honesty in academic work and may be treated as a case of academic dishonesty. The procedures regarding how the College deals with cases of academic dishonesty appear in The Catalogue, under the heading "Academic Honesty."

Students with Disabilities:

Cornell College makes reasonable accommodations for persons with disabilities. Students should notify the Coordinator of Academic Support and Advising and their course instructor of any disability related accommodations within the first three days of the term for which the accommodations are required, due to the fast pace of the block format. For more information on the documentation required to establish the need for accommodations and the process of requesting the accommodations, see http://www.cornellcollege.edu/academic-support-and-advising/disabilities/index.shtml.