Welcome to the
Department of Engineering Education!

ENGR 1182 – Introduction to Engineering
II Graphics 01
Today’s Objectives

- Teaching Team Introduction
- Course Structure & Expectations
- Course Syllabus
- Glass Box Theory
- Rapid Prototyping Introduction
- Solid Works Examples
- Graphics 01
  - Develop visualization skills using coded plans and snap cubes
  - Use coded plans to sketch objects in isometric view
- GP01 In-Class Activity
- GP01 After-Class Assignment – Get Your COURSE PACKET
Teaching Team Introduction

- Faculty Leader
- Graduate Teaching Associate - GTA
- Undergraduate Teaching Associates - UTA

Get to know us, we’re here to make you successful!
ENGR 1182 Course Structure

- Three Components of ENGR 1182

**Graphics**
- Visualization Skills
- Hand Sketching
- SolidWorks Intro

**SolidWorks**
- 3D CAD
- Real World Application

**Advanced Energy Vehicle (AEV)**
- Team Engineering Design Project
- Autonomous Robot using an Arduino micro-controller
- Semester Long Project
- Final Competition

### Midterms
- **Midterm 1:** Weeks 1-5
- **Midterm 2:** Weeks 5-10
- **Final Documentation:** Weeks 3-16
Structure & Expectations

The Flipped (or inverted) Classroom

- Students watch lectures/study materials online before class.
- Concept engagement takes place in the classroom with help of instructional team (same as 1181).
**Learning Modules**

**Module Example**

**Topic:** Graphics 02

**Pre-Reading Assignment:**

**Quiz:** GP02 (on Carmen)

**Lecture:** Graphics 02 (on Carmen)

**Topics:**
- Isometric Sketching from Different View Points
- Inclined and Curved Surfaces in Isometric Sketching

**GP02 Activity**

**GP02 Application**

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**Before Class**

**Reading Material**

**Carmen Quiz**

**Preparation**

**In Class Activity**

**Practice and Assessment**

**Lecture or Demonstration**
Required Materials

Before Class

Reading

Local Bookstores

In Class Activity

Drawing Packet: ENGR 1182 Course Packet
Local Bookstores
Logging In

- Press `<CTRL> + <ALT> + <DELETE>`

- Enter OSU credentials
  - OSU lastname.#
  - OSU Password
Carmen

- [https://carmen.osu.edu](https://carmen.osu.edu)
- Online tool for some course resources
  - Gradebook, quizzes, journals
  - Use OSU login
  - 24/7 access
- Communication between instructional staff and students
OSU Email

- Check your OSU email daily for important information and updates.
- Use OSU email for all communication with your instructional team.
- We cannot email private or personal information to you via non-OSU email addresses.
Carmen

- https://carmen.osu.edu

- Online tool for all course resources
  - Presentations, Class Activities & Applications, Gradebook, quizzes, journals
  - Use OSU login
  - 24/7 access

- Communication between instructional staff and students
# Website Organization

## Graphics 1 - Isometric Sketching and Coded Plans

1182 Website Home  
1182 Website Content  
1182 Class Schedules

<table>
<thead>
<tr>
<th>Before class:</th>
<th>1. Textbook Reading - Section 2.06, 2.07.01, 2.11.01</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-class:</td>
<td>Topic: Course Introduction</td>
</tr>
<tr>
<td></td>
<td>1. Instructor's Presentation - Powerpoint or PDF</td>
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<tr>
<td></td>
<td>2. Introduce Instructional Staff</td>
</tr>
<tr>
<td></td>
<td>3. Go over the 1182 Syllabus</td>
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<tr>
<td></td>
<td>4. Purchase (1) the 1182 Course Packet and (2) the Textbook</td>
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<td></td>
<td>6. Explore the resources on the 1182 Content Page and the Resources Page</td>
</tr>
<tr>
<td>Topic: Isometric Sketching and Coded Plans</td>
<td>1. Instructor's Presentation - Powerpoint or PDF - SolidWorks Image for Coded Plans SLDPR and SLDWR</td>
</tr>
<tr>
<td></td>
<td>2. Optional &quot;Example&quot; Presentation of 1st In-Class GP_01 problem - Powerpoint or PDF</td>
</tr>
<tr>
<td></td>
<td>3. In-Class Activity - PDF or Word</td>
</tr>
<tr>
<td>After class:</td>
<td>1. GP_01 Homework - PDF or Word - due at the beginning of Graphics 2</td>
</tr>
<tr>
<td></td>
<td>2. Register and complete the CATME survey - CATME - due at midnight</td>
</tr>
<tr>
<td></td>
<td>3. Explore the Student Resource Guide</td>
</tr>
<tr>
<td></td>
<td>4. Explore the 1182 Content Page and the Resources Page</td>
</tr>
<tr>
<td>Journal:</td>
<td>Journal - due on selected Sundays at 11:59 pm - Carmen</td>
</tr>
</tbody>
</table>

Next class: Graphics 2 - Isometric Sketching from Different View Points + Inclined and Curved Surfaces in Isometric
Syllabus Review

- Assignment Policy
- Makeup Exam Policy and Guidelines
- Hands-on Laboratory
- Attendance and Participation
- Assessment and Evaluation
- Grading
- Online Evaluation Tools
- Journals
- Team Evaluations
- Academic Misconduct

**NOTE:**
In order to receive a passing grade in this course, a minimum grade of 50% is required in all three course components:
- Class Assignment
- Design Project
Team Formation

- You will work in teams of four on many assignments during the semester.
- Teams are created using a Team-Maker tool.
- You should have received email with a link.
- This survey needs to be completed soon.
Methods of Getting Help

- UTA Tutoring
  - Available in First-Year Engineering computer lab (HI 324)
  - Staffed Mon-Thurs 9-7, Fridays 9-3

- GTA
  - Make an appointment or stop by office hours, they’ll appreciate it!

- Instructor
  - Make an appointment or stop by office hours.
Glass Box Theory – Orthographic Projection
ENGR 1182
Glass Box Theory – Orthographic Projections

- Place a Glass Box around the Object

- Project Lines / Points from Object to Each Glass Surface (Front, Top & Right Side)

- “Unfold” Glass Box to Create Orthographic Projections
Glass Box Simulation

IN SLIDE SHOW MODE CLICK HERE TO RUN SIMULATION
Steps in Creating the Orthographic Projection Sketch
Example Object

- Front View
- Right Side View
- Top View
Rapid Prototyping Introduction
ENGR 1182
Objectives

- What is Rapid Prototyping?
- How a 3D printer works
- 3D Printing in EED
- Laser Cutting in EED
- Design your own part option
What is Rapid Prototyping?

- Rapid Prototyping is a set of methods for quickly creating scale or full-size models of parts or assemblies to determine validity of design.

- Rapid prototyping saves time and money

- It is often used when testing fit of design in assembly

- Common types of modern rapid prototyping
  - 3D printing
  - Laser cutting
What is 3D printing?

- Wikipedia states that 3D Printing, also known as Additive Manufacturing “refers to various processes used to synthesize (create) a three-dimensional object”

- The printer software analyzes solid model files that have been converted into an .stl format to create the code needed to print objects.

- The printer lays down material layer by layer to create the desired object.

- 3D Printing is less wasteful than traditional machining.
  - Traditional machining removes material from a block to create the desired part and is called subtractive manufacturing.
  - 3D printing uses a supply of new raw material to create the desired part and is called additive manufacturing.
3D Printing in the EED

- The EED has 11 *MakerBot Replicator 2* printers for lab support.
- These printers extrude PLA (polylactic acid) plastic and dispense it onto the build plate.
MakerBot Features

- The time required to create a printed part varies with the size and complexity of the object.
  - Variables such as layer thickness, the quantity of feature boundaries and internal density are all variables that can be adjusted based on desired results.
  - Our MakerBot printers use the same material for making both the model and the automatic supports, unlike some higher-end printers which use a water-soluable material for supports, and allows for printing of complex assemblies, etc.
  - The MakerBot build envelope is about 11” wide x 6” deep x 6” tall.
  - Due to the FDM printing method, parts will have a “grain” to them based on how they are oriented on the build plate. Printed parts will be strongest in the horizontally-printed direction, which flows with the grain.
Design Guidelines

Guidelines:

• Avoid very small details (less than 1/8"), small text (at least #12 font, and bold format), and overhanging geometry (think wings).

• Avoid designing parts with large, flat bottom features, as these tend to warp. Flat panel parts are better created using the laser cutter.

• Object geometry with an angle greater than 45-deg can be printed without supports (see next slide). Geometry with an angle less than 45-deg will require supports which will require some removal/shaving following printing. See bottom picture.

• The size of the object to be printed must fit inside 11X6X6 inches.

Tolerances:

• The Makerbots are pretty precise, but not perfect.

• Machine tolerances, plastic warping and shrinkage and geometry designs, all have an effect on the size of the final part being printed.

• If you are designing parts to fit other parts, you should leave some tolerances (gaps) in them to allow parts to fit together. It is recommended to leave about .015” gap on parts that fit onto other parts.

• If you have holes that need to be an exact fit, design the holes a few thousandths smaller, and then drill them to the final size.
What is Laser Cutting?

- Laser cutting is a subtractive manufacturing method that uses a powerful laser to etch the surface, or cut completely through many materials.
  - Common materials include: acrylics and other plastics, wood, fabric, rubber, ceramics, organic materials, etc.

- Etching text or graphics onto surfaces adds aesthetic value

- EED Laser – Manufactured in the USA by Universal Laser Systems →
  - It is another way for students in 1182 to have parts created for their AEV project.
Here are a few of the many parts in the AEV kits were cut using a laser
Laser Cutting in the EED

- Our laser can cut or etch most materials other than metal.

- Materials available to use for AEV parts include:
  - 1/8” and 1/4” acrylic – clear or red color
  - 1/8” plywood, 1/4” MDF
  - 1/8” polypropylene - whitish plastic with holes in it used for many of the AEV panels
  - 3/32” ABS – black plastic, textured on one side, used for AEV main support brackets that attach to the wheels.

- Tolerances
  - The laser creates a “kerf”, much like a sawblade, in that it makes a slot in the material when it cuts. The kerf is about .006” wide, so, it is a good idea to offset holes, cuts, etc accordingly. It is better to have a little extra tolerance of a few thousandths of an inch for where your laser cut parts will fit other parts. The laser follows the center of the line that it cuts, so in reality, only about half of the kerf affects your line geometry, or about .003”. For holes, it takes a full kerf off of the diameter because it is a circle.

- Words or graphics can be etched onto surface as required
  - Etching does not work well on ABS or polypropylene.
Design Your Own Part

- As you learn more about how you are going to construct your team’s AEV, remember that your design need not be limited to the supplied parts since you be able to use the Rapid Prototyping process to manufacture an additional part.

- The part may be functional of decorative, but producing a function part is strongly encouraged.
Design Your Own AEV Part

- Problem SW_3D requires that each team member design and describe the part's function using either Laser cutting or 3D printing. Submission (for grade) is week 7 (SolidWorks 5 presentation)

- As an option, each team will have the opportunity to select one of the teams parts to be manufactured. Submission of that part is scheduled for week 8. (LAB_8A presentation)
SolidWorks Animation Examples

ENGR 1182
UTUBE SOLIDWORKS VIDEOS

https://www.youtube.com/watch?v=GSIOtcP3WOE

https://www.youtube.com/watch?v=r7-acP6N5G8

https://www.youtube.com/watch?v=97x-Xs8g9Ps
Things to do before next class

- Purchase your:
  - Book – Engineering Design by Lieu & Sorby
  - Course Packet

- Read your assigned material