

# CSAM Module II for MEEN 252 – Introduction to Computer Aided Drafting and Design (CADD)

## Engineering Design Using Additive Manufacturing (AM) and Cybersecurity for AM

**Unit Description:** As mechanical engineering students advance their 3D visualization and engineering graphics skills while learning to use CAD software, CSAM Module II addresses CAD design for additive manufacturing and applying VR tools to detect potential sabotage.

**References:** All materials for this module will be available on Moodle for students in Introduction to CADD classes.

### Prerequisites by Topic:

1. Knowledge and understanding of Cybersecurity for Additive Manufacturing (CSAM) basics

Students who were not exposed to CSAM content in Freshman Engineering I (ENGR 120) or those who want a refresher should view the videos on the CSAM project website at [www.subr.edu/page/ENGR120\\_CSAM](http://www.subr.edu/page/ENGR120_CSAM).

- **From Visualization to Realization** provides an overview of engineering graphics with introduction to graphics for engineering design, overview of additive manufacturing for engineering design, and introduces the necessity for cybersecurity in the AM process. The video ties engineering graphics to visualization using VR, cybersecurity using VR and presents the concept of visualization and spatial reasoning (computational thinking skills) as key to realization of engineering design and development of engineering ability.
- **Additive Manufacturing and Cyber Security** videos introduce basic concepts of the 3D AM printing process and general cybersecurity issues

Learning Assessment: Quiz (Moodle – completion credit): Knowledge of key terminology and understanding of connections between key concepts from the videos.

2. Knowledge and understanding of CAD design software as introduced and used in the current course.

### Module Objectives:

Students will demonstrate:

1. Application of engineering design tools by using CAD software to generate 3D models and STL files for additive manufacturing
2. Application of VR tools to investigate CAD designs for discrepancies based on a case study involving a cyber attack on an AM process.

### Student Learning Outcomes:

Upon completion of this unit, students will have the ability to:

1. Apply advanced graphics visualization skills to CAD design drawings for AM
2. Apply understanding of CSAM to examine an attack on an AM design product and use VR tools identify discrepancies

### Module Educational Strategies:

1. Provide opportunities to learn the module materials through videos.
2. Provide opportunities to work in teams to apply CAD software knowledge to design and create parts for AM.
3. Provide opportunities to work in teams to learn about AM threats through a case study of real-world applications.
4. Provide opportunities to work in teams to present findings based on an AM threat case study.

CSAM Module II will be covered in two (2) weeks.

### Module Contents and Activities:

| Activity | Topic  |
|----------|--|
| 1        | Cyber-Physical Systems and the Internet of Things (IoT) Instructional Videos |

To build on basic understanding of CSAM topics, students should view the videos available on the project website at [www.subr.edu/page/MEEN252\\_CSAM](http://www.subr.edu/page/MEEN252_CSAM). These videos explore meanings and implications of systems used by humans to connect physical components, such as 3D printers, through digital networks.

Learning Assessment: Quiz (Moodle – completion credit): Knowledge of key terminology and understanding of relationships between/among key concepts from the videos

## 2 CSAM Module II CADD Project

Students will view (or review) the case study: *dr0wned – AM Cyber Attack*. Video ([www.subr.edu/page/ENGR120\\_CSAM](http://www.subr.edu/page/ENGR120_CSAM)). Working in teams, students are assigned to draw the drone propeller from the dr0wned case study. Some teams will design the normal propeller while others will design the sabotaged propeller. Teams will compare their design drawings in the CAVE to explore which designs are intact and which have been compromised.

Learning Assessment: Team project presentations. (Application; Reflective assignment)