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Semester effective: Spring 2018

Engineering (ENGR) 1510 Engineering Graphics and Introduction to Design with Lab (3 Units) CSU: UC

Prerequisite: Successful completion of Math 1530 Plane Trigonometry with a grade of 'C' or better

Prerequisite knowledge/skills: Before entering the course the student should be able to:

1. Identify special triangles and their related angle and side measures;
2. Evaluate the trigonometric function of an angle in degree and radian measure;
3. Manipulate and simplify a trigonometric expression;
4. Solve trigonometric equations, triangles, and applications;
5. Graph the basic trigonometric functions and apply changes in period, phase and amplitude to generate new graphs;
6. Evaluate and graph inverse trigonometric functions;
7. Prove trigonometric identities;
8. Convert between polar and rectangular coordinates and equations;
9. Graph polar equations;
10. Calculate powers and roots of complex numbers using DeMoivre's Theorem, and
11. Represent a vector (a quantity with magnitude and direction) in the form $a_i + b_j$.

Advisory: Eligibility for English 1500 strongly recommended

Total Hours: 32 hours lecture; 48 hours lab (80 hours total)

Catalog Description: This course covers the principles of developing engineering 3D designs and 2D drawings including proper design, dimension and visualization techniques. Topics include the engineering design process and the development of skills to create and properly use part and assembly relationships, visualization skills, orthographic projections and mechanical dimensioning and tolerancing practices. The use of CAD software, 3D printing and plotting is an integral part of the course. C-ID: ENGR 150

Type of Class/Course: Transfer Degree Credit

Text: Shih, Randy H. *Autodesk Inventor 2016 and Engineering Graphics, an Integrated Approach*; SDC Publications, 2015. Print.

Lab Manual: Sheryl Sorby. *Developing Spatial Thinking*. Higher Education Services. 2016. Print.

Course Objectives:

By the end of the course a successful student will be able to:

1. Apply the engineering design process to a design project,
2. Use CAD software to create:

- 3 Dimensional (3D) models and assemblies
- 2 Dimensional (2D) engineering part and assembly drawings,
- 3. Apply rules of orthographic projection to create multi-view drawings,
- 4. Create pictorials from orthographic views,
- 5. Create auxiliary and section views of an object following correct conventions, and
- 6. Apply standards of dimensioning and tolerancing to engineering drawings.

Course Scope and Content (Lecture):

- Unit I Engineering Design
 - A. Principles of Design
 - B. Types and Tradeoff Decisions
 - C. Designing in 3D

- Unit II Basic Engineering Drawing Concepts and Types
 - A. Detail, Assembly, Manufacturing Process
 - B. Format, ANSI (American National Standard Institute) Standards
 - C. Other drawing types: Process, Schematic, Architectural

- Unit III Visualization skills
 - A. Conceptualization
 - B. Sketching

- Unit IV 3D Solid Modeling
 - A. Viewing Concepts
 - B. Geometry Creation Options
 - C. Solids and Surfaces
 - D. Parametric Dimensions
 - E. Linking with Computer Aided Manufacturing (CAM) and Engineering Analysis

- Unit V 2D Drawing Generation
 - A. Detail and Assembly
 - B. Electronic vs. physical drawing
 - C. Drawing Management
 - D. Bills of Material (BOM's)

- Unit VI Views
 - A. Multi-view – purpose and projections
 - B. Line Types – object, hidden, center, break
 - C. Auxiliary Views – purpose and type
 - D. Section Views - Purpose and Types

- Unit VII Scales
 - A. Purpose in engineering and architect
 - B. Typical Factors
 - C. Callouts

- Unit VIII Dimensioning & Tolerancing
 - A. ANSI Standards



- B. Lines, positions, size
- C. Three Techniques
- D. GD&T (Geometric Design & Tolerances)

- Unit IX Fasteners & Welding
- A. Types and Purposes
 - B. Symbols
 - C. Drill Callouts

Course Scope and Content (Laboratory):

- Unit I Starting CAD System
- A. Basic Commands
 - B. Coordinates & Views
 - C. Toolbars and Menus
 - D. Units of Measure and Scale
 - E. Help
- Unit II 3D Modeling
- A. Coordinate Systems
 - B. Viewpoints
 - C. Sketching
 - D. Geometry Creation
 - E. Parametric Dimensioning
 - F. Part Assemblies
 - G. Types: solid, wireframe, surface
- Unit III Viewing Commands
- A. Pan
 - B. Zoom
 - C. Scroll
 - D. Views
- Unit IV Drawing Creation
- A. Automatic Generation
 - B. View Placement
 - C. Title Block and Format
- Unit V Edit
- A. Selection Sets
 - B. Erase
 - C. Copy, Mirror, Move, Offset, Array
 - D. Trim, Fillet, Break, Lengthen
- Unit VI Organize
- A. Layers & Line types
 - B. Colors
 - C. Blocks



- Unit VII Text and Hatch
- A. Style
 - B. Justification
 - C. Edit
 - D. Patterns
 - E. Areas
- Unit VIII Dimensioning
- A. Types (linear, radial, angular, ordinate)
 - B. Edit
 - C. Tolerancing
- Unit IX Getting Information
- A. Lists
 - B. Measure
 - C. Locations
 - D. Volumes, Areas and Perimeters

Learning Activities Required Outside of Class:

The students in this class will spend a minimum of 4 hours per week outside of the regular class time doing the following:

1. Studying assigned text, handout materials and class notes
2. Reviewing and preparing for quizzes, midterm and final exams
3. Completing individual projects using the CAD software including sketches, models, drawings, assemblies and assembly drawings

Methods of Instruction:

1. Lecture, demonstrations and discussions
2. Individual projects with emphasis on hands-on work by applying lecture principles on the CAD system software
3. Group projects with emphasis on design creativity, problem solving and teamwork

Methods of Evaluation:

1. Quizzes
2. Exams
3. Participation
4. Individual and group assignments & projects
5. Oral presentations
6. Design project

Laboratory Category: Extensive Laboratory

Pre delivery criteria: All of the following criteria are met by this lab.

1. Curriculum development for each lab.
2. Published schedule of individual laboratory activities.
3. Published laboratory activity objectives.



4. Published methods of evaluation.
5. Supervision of equipment maintenance, laboratory setup, and acquisition of lab materials and supplies.

During laboratory activity of the laboratory: All of the following criteria are met by this lab.

1. Instructor is physically present in lab when students are performing lab activities.
2. Instructor is responsible for active facilitation of laboratory learning.
3. Instructor is responsible for active delivery of curriculum.
4. Instructor is required for safety and mentoring of lab activities.
5. Instructor is responsible for presentation of significant evaluation.

Post laboratory activity of the laboratory: All of the following criteria are met by this lab.

1. Instructor is responsible for personal evaluation of significant student outcomes (lab exercises, exams, practicals, notebooks, portfolios, etc.) that become a component of the student grade that cover the majority of lab exercises performed during the course.
2. Instructor is responsible for supervision of laboratory clean up of equipment and materials.

Supplemental Data:

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| TOP Code: | 090100: Engineering, General (requires |
| SAM Priority Code: | E: Non-Occupational |
| Distance Education: | Not Applicable |
| Funding Agency: | Y: Not Applicable(funds not used) |
| Program Status: | 1: Program Applicable |
| Noncredit Category: | Y: Not Applicable, Credit Course |
| Special Class Status: | N: Course is not a special class |
| Basic Skills Status: | N: Course is not a basic skills course |
| Prior to College Level: | Y: Not applicable |
| Cooperative Work Experience: | N: Is not part of a cooperative work experience education program |



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|---------------------------------|-------------------|
| Eligible for Credit by Exam: | E: Credit By Exam |
| Eligible for Pass/No Pass: | NO |
| Taft College General Education: | NONE |