ENGR A180: ENGINEERING GRAPHICS

Item	Value
Curriculum Committee Approval Date	03/08/2023
Top Code	090100 - Engineering, General (requires Calculus) (Transfer)
Units	4 Total Units
Hours	126 Total Hours (Lecture Hours 45; Lab Hours 81)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Grading Policy	Standard Letter (S)

Course Description

This course covers the fundamentals of the graphic communication necessary for engineering design. Freehand sketching and Computer-Aided Design (CAD) are the main techniques utilized in this course. 2-D and 3-D visualization skills are developed through the analysis and practice of orthographic projections, principle of descriptive geometry, geometric dimensioning and tolerancing, working drawings and engineering design process. PREREQUISITE: MATH A120 or appropriate placement. Transfer Credit: CSU; UC. C-ID: ENGR 150.**C-ID:** ENGR 150.

Course Level Student Learning Outcome(s)

1. Generate 2-D and 3-D engineering drawings using sketching and CAD techniques.
2. Generate multiview drawings and pictorial projections using standard drawing conventions recognized in the engineering field.
3. Proper use of geometric dimensioning and tolerancing for the engineering design process.

Course Objectives

- 1. Learn the use of different line types to represent different features in 2-D drawings
- 2. Demonstrate proficient drawing skills using freehand sketching and CAD.
- 3. Develop and improve 3-D visualization skills.
- 4. Analysis and creation of 3-D axonometric projections (isometric and oblique).
- 5. Develop engineering drawing skills utilizing principles of multiview drawings, pictorial drawings, and descriptive geometry.
- 6. Complete drawing with geometric dimensions and tolerances according to standard engineering and manufacturing techniques.
- 7. Practice the use of engineering and architect scales.
- 8. Work effectively in groups during the engineering design projects which involve problem solving, report writing, and oral presentations.
- 9. Develop an ability to decompose complex shapes and reconstruct them with geometric constructions techniques.
- 10. Analysis and creation of 2-D orthographic projections.
- 11. Acquire an in-depth understanding of the engineering design process and improve creativity in solving engineering problems.
- 12. Apply principles of engineering graphics to produce a complete set of working drawings for product design and fabrication.

Lecture Content

LETTERING Engineering Standards for Lettering Lettering Techniques LINE TYPES Alphabet of Lines Standards for Line Type and Intensity 2-D FREEHAND SKETCHING 2-D Sketching Techniques Square Method 3-D FREEHAND SKETCHING Axonometric Drawings Isometric Projections Oblique Projections 3-D Sketching Techniques GEOMETRIC CONSTRUCTIONS (SKETCHES AND CAD) Lines and Angles Fillets and Rounds Tangent Lines and Circles SCALES AND SIZES (SKETCHES AND CAD) Measurement Systems Drawing Scales Engineering and Architect Scales ORTHOGRAPHIC PROJECTIONS (SKETCHES AND CAD) Multiview Drawings The Six Standard Views Projection Methods First- and Third-Angle Projections Necessary Views SECTION VIEWS (SKETCHES AND CAD) The Cutting Plane Full Sections Section Techniques and Lining Half Sections Partial Sections: Broken-Out, Revolved Sections, Removed, Aligned an> DESCRIPTIVE GEOMETRY (Optional) Methods of Descriptive Geometry Principles of Descriptive Geometry AUXILIARY VIEWS (SKETCHES AND CAD) True Size and Shape Auxiliary Planes and Projections Successive Auxiliary Views Partial Auxiliary Views DIMENSIONING (SKETCHES AND CAD) Standard Dimensioning Techniques Dimension Units and Values Dimension Symbols Placing and Showing Dimensions TOLERANCING (SKETCHES AND CAD) Standard Tolerancing Techniques Mating Parts Standard Limits and Fit Tolerances in Assemblies THREADS AND FASTENERS (SKETCHES AND CAD) Thread terminology and Forms Thread Standards and Symbols Standard Fasteners Types WORKING DRAWINGS (CAD) Detail Drawings Assembly Drawings Mating Parts ENGINEERING DESIGN (CAD) Principles of Engineering Design and Manufacturing Top-Down and Bottom-Up Design 3-D Modeling with CAD

Lab Content

FREEHAND SKETCHING Lines and Lettering Techniques 2-D drawings 3-D drawings, Isometric and Oblique Projections Geometric Constructions Scales and Sizes Orthographic Projections Section Views Auxiliary Views Geometric Dimensioning and Tolerancing Threads and Fasteners Basic Assembly Drawings COMPUTER-AIDED DESIGN CAD Fundamentals 2-D Geometric Constructions Multiview Drawings with CAD Section Views Auxiliary Views Dimensioning and Tolerancing Templates and Scales 3-D Geometric Constructions ENGINEERING DESIGN 3-D Modeling Detail Drawings Assembly Drawings

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- DE Online Lecture (02X)
- Lab (04)
- DE Live Online Lab (04S)
- DE Online Lab (04X)

Instructional Techniques

The primary mode of instruction is the lecture/demonstration method and assisting students individually during lab. There is also an extensive use of computers for the CAD part of the course.

Reading Assignments
1 hr. textbook readings for the topics covered in lecture.

Writing Assignments
0.25 hrs. project presentation.

Out-of-class Assignments
5.5 hrs. problem solving exercises and homework assignments.

Demonstration of Critical Thinking
Apply standard techniques of engineering graphics to generate technical drawings and solve problems according to engineering standards.

Required Writing, Problem Solving, Skills Demonstration
Demonstrate 3-D visualization skills with the creation of multiview projections from 3-D drawings and vice versa. Apply graphic methodologies to design engineering products. Create 2-D and 3-D drawings with CAD software.

Eligible Disciplines
Engineering: Masters degree in any field of engineering OR bachelors degree in any of the above AND masters degree in mathematics, physics, computer science, chemistry, or geology OR the equivalent. (NOTE: A bachelors degree in any field of engineering with a professional engineers license is an alternative qualification for this discipline.) Masters degree required. Title 5, section 53410.1

Textbooks Resources
1. Required Giesecke, F.E., Mitchell, A., Spencer, H.C., Hill, I.L., Dygdon, J.T, Novak, J.E., Lockhart, S., Goodman, M., Johnson, C.M.. Modern Graphics Communications, 5th ed. Prentice Hall, 2018 Rationale: - 2. Required Bertoline, Wiebe, Hartman, Ross. Fundamentals of Graphics Communication, 6th ed. McGraw-Hill, 2011 Rationale: Textbook recommended by C-ID. 3. Required Raison, M.E.. Engineering Graphics Principles with Geometric Dimensioning and Tolerancing, 2nd ed. SDC Publications, 2017 4. Required Shih, R.H.. AutoCAD 2019 Tutorial First Level 2D Fundamentals, 11th ed. SDC Publications, 2019 5. Required Shih, R.H.. AutoCAD 2019 Tutorial Second Level 3D Modeling, 11th ed. SDC Publications, 2019 6. Required Tran, P. . SOLIDWORKS 2019 Basic Tools, 10th ed. SDC Publications, 2019