ENGR R150: ENGINEERING GRAPHICS AND DESIGN

Originator
jwmiller

College
Oxnard College

Discipline (CB01A)
ENGR - Engineering

Course Number (CB01B)
R150

Course Title (CB02)
Engineering Graphics and Design

Banner/Short Title
Engineering Graphics

Credit Type
Credit

Start Term
Fall 2021

Catalog Course Description
This course focuses on the principles of engineering graphics which are necessary to communicate engineering designs. The use of computer-aided drafting CAD in 2 and 3 dimensions as well as drawings produced by hand are skills of great necessity in engineering fields and will be used throughout the course. Using the principles of orthographic drawing, pictorial drawing, and descriptive geometry, students will learn how to visualize, understand, and produce coherent graphics and designs. Central topics include; orthographic projections, graphical presentation of various surfaces, auxiliary and sectional views, dimensioning, and tolerances.

Taxonomy of Programs (TOP) Code (CB03)
0924.00 - *Engineering Technology, General (requires Trigonometry)

Course Credit Status (CB04)
D (Credit - Degree Applicable)

Course Transfer Status (CB05) (select one only)
A (Transferable to both UC and CSU)

Course Basic Skills Status (CB08)
N - The Course is Not a Basic Skills Course

SAM Priority Code (CB09)
D - Possibly Occupational

Course Cooperative Work Experience Education Status (CB10)
N - Is Not Part of a Cooperative Work Experience Education Program

Course Classification Status (CB11)
Y - Credit Course

Educational Assistance Class Instruction (Approved Special Class) (CB13)
N - The Course is Not an Approved Special Class

Course Prior to Transfer Level (CB21)
Y - Not Applicable

Course Noncredit Category (CB22)
Y - Credit Course

Funding Agency Category (CB23)
Y - Not Applicable (Funding Not Used)

Course Program Status (CB24)
1 - Program Applicable

General Education Status (CB25)
Y - Not Applicable

Support Course Status (CB26)
N - Course is not a support course

Field trips
Will not be required

Grading method
Letter Graded

Alternate grading methods
Credit by exam, license, etc.

Does this course require an instructional materials fee?
No

Repeatable for Credit
No

Is this course part of a family?
No

Units and Hours

Carnegie Unit Override
No

In-Class

Lecture
Minimum Contact/In-Class Lecture Hours
35
Maximum Contact/In-Class Lecture Hours
35

Activity

Laboratory
Minimum Contact/In-Class Laboratory Hours
52.5
Maximum Contact/In-Class Laboratory Hours
52.5

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
87.5

Total Maximum Contact/In-Class Hours
87.5

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class
Minimum Outside-of-Class Hours
70
Maximum Outside-of-Class Hours
70

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
157.5
Total Maximum Student Learning Hours
157.5

Minimum Units (CB07)
3
Maximum Units (CB06)
3

Prerequisites
MATH R116

Entrance Skills

Entrance Skills

Students are expected to understand aspects of trigonometry used in class that correlate with spatial geometry. Students are also expected to make use of trigonometry throughout the course regarding designs and the production of graphics.

Prerequisite Course Objectives

MATH R116-Identify special triangles and their related angle and side measures;
MATH R116-Evaluate the trigonometric function of an angle in degree and radian measure;
MATH R116-Manipulate and simplify a trigonometric expression;
MATH R116-Solve trigonometric equations, triangles, and applications;
MATH R116-Graph the basic trigonometric functions and apply changes in period, phase and amplitude to generate new graphs;
MATH R116-Evaluate and graph inverse trigonometric functions;
MATH R116-Convert between polar and rectangular coordinates and equations;
MATH R116-Represent a vector (a quantity with magnitude and direction) in the form and ai+bj.

Requisite Justification

Requisite Type
Prerequisite

Requisite
MATH R116

Requisite Description

Course not in a sequence

Level of Scrutiny/Justification

Content review

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	Demonstrate the ability to generate two- and three-dimensional and pictorial drawings of solid models using Computer Aided Drafting (CAD) for an engineering product using standard drawing conventions recognized in the engineering field.
2	Produce a properly scaled model, including cross-sectional views, of a given physical object using CAD software.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	Apply rules of orthographic projection to create multi-view drawings.
2	Create pictorials from orthographic views.
3	Use CAD software to create2D and 3D engineering drawings, including working drawings and assembly drawings.
4	Create auxiliary and section views of an object following correct conventions.
5	Apply standards of dimensioning and tolerancing to engineering drawings.
6	Apply the engineering design process to a design project.

Course Content

Lecture/Course Content

1. Basic engineering drawing concepts
   a. Design
   b. Communicating a design
      i. Sketching
      ii. Technical drawing
      iii. Computer-aided drawing (2D and 3D modeling)
   c. Standards
   d. Manufacturing
   e. Drawing format and contents
      i. Sheet sizes
      ii. Drawing
      iii. Zoning
      iv. Engineering and Architect Scales
      v. Notes
      vi. Title block
      vii. Revision history block
      viii. Tolerance and projection block
2. Orthographic projections
   a. Multi-view drawings and the six principle views
   b. The glass box method
   c. The standard views
   d. Rules for line creation and use
      i. Hidden lines
      ii. Center lines
      iii. Phantom lines
      iv. Break lines
      v. Line type precedence
   e. Creating an orthographic projection
      i. Projection symbol

3. Pictorial drawings
    a. Pictorial types
    b. Oblique projections
    c. Visualization
    d. Isometric pictorials
        i. Drawing linear features in an isometric pictorial
        ii. Drawing circles and radii in an isometric pictorial
        iii. Drawing cylinders in an isometric pictorial
4. Dimensioning
    a. Detailed drawings
    b. Learning to dimension
    c. Dimension appearance
        i. Lines used in dimensioning
        ii. Types of dimensioning
        iii. Arrowheads, lettering, and symbols
    d. Feature dimensioning
    e. Dimensioning rules
        i. Dimension placement, spacing, and readability
        ii. Over/under dimensioned parts
        iii. Manufacturing
        iv. Functional dimensioning
        v. Tolerancing
5. Sectioning
    a. Sectional views
        i. Creating a sectional view
        ii. Lines used in sectional views
        iii. Rules of sectioning
    b. Basic sections
        i. Full section
        ii. Half section
        iii. Offset section
    c. Advanced sections
6. Advanced Drawing Techniques
    a. Advanced view techniques
        i. Detail views
        ii. Partial views
        iii. Auxiliary Views
7. Tolerancing
    a. Tolenancing and interchangeability
    b. Tolerancing standards
    c. Tolerancing types
    d. Shaft-hole assembly
    e. Inch tolerances
    f. Metric tolerances
    g. Selecting tolerances
    h. Tolerance accumulation
    i. Formatting tolerances
8. Threads and fasteners
    a. Fasteners
    b. Screw thread definitions
    c. Types of thread
    d. Drawing screw threads
    e. Unified threads
    f. Metric threads
    g. Drawing bolts
    h. Bolt and screw clearances
    i. Standard parts
9. Assembly drawings

a. Definitions
    i. Drawing order
b. Components of an assembly drawing
    i. Assembly drawing views
    ii. Part identification
    iii. Parts list and bill of material
c. Section views
d. Things to include and not to include
    i. Hidden and center lines
    ii. Dimensions

Laboratory or Activity Content

1. The Lab portion of the course will consist largely of the utilization of CAD software to directly demonstrate proper techniques and construction of engineering graphics in tasking the students with various projects. These projects will entail current concepts and procedures focused on in the lecture portion of the course. The main programs used will be AutoCAD and Solidworks.
2. Design, visualization, scales, and drawing basics
3. CAD in 2 and 3 Dimensions
4. Orthographic projections
5. Oblique projections, isometric pictorials, and multi-view drawings
6. Dimensioning
7. Sectioning, detail and auxiliary views
8. Tolerancing
9. Threads and fasteners
10. Assembly drawings

Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):

Problem solving exercises
Written expression

Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):

Computational homework
Graphic/architectural designs
Laboratory activities
Laboratory reports
Objective exams
Projects
Problem-Solving Assignments
Problem-solving exams
Quizzes

Instructional Methodology

Specify the methods of instruction that may be employed in this course

Computer-aided presentations
Distance Education
Demonstrations
Instructor-guided use of technology
Laboratory activities
Lecture
Small group activities

Describe specific examples of the methods the instructor will use:

1. Computer aided presentation: The instructor will employ the computer to aid in the presentation of course materials which would include the direct usage and application of the graphics programs.
2. Demonstrations: The instructor will demonstrate usage of the programs as to convey its application in producing proper engineering graphics.
3. Distance Education: When applicable, recordings of lectures will be used to convey subject matter. Also, the use of discussion boards and virtual meeting will be used to impart course material and allow students to ask questions regarding the course.

4. Instructor guided analysis: The instructor will work through various problems and exercises during class that explore a given design and/or graphic in which the students will follow along, answering questions posed by the instructor. This will also serve as a forum for students to ask particular questions regarding the logic, methods, and program usage employed to produce said graphics and/or designs.
5. Laboratory activities: The Lab portion of the class is embedded in the lecture as course material discussed by the instructor and exercises/activities are often done simultaneously.
6. Lecture: The instructor will deliver the course subject matter via in person lectures to the students. For example; Proper dimensioning of engineering graphic.
7. Small group activities: These may be employed in the form of group exercises in working through the production of a particular graphic and/or that achieves a desired effect.

Representative Course Assignments

Writing Assignments

1. Students will write details of processes in which a particular design is produced and instructions for any assembly of a multi-piece system. Documentation of all aspects of a design will accompany any graphics produced.

Critical Thinking Assignments

1. Students will typically be tasked with designing and producing proper engineering graphics of an object that has a specific purpose or purposes. Students must analyze what that purpose is and develop a proper design that fits the situation at hand. For instance; Design and produce a proper multi-view drawing of an optical mount for a typical DSLR type camera.

Reading Assignments

1. Regular textbook readings that reinforce the concepts discussed and/or demonstrated during the class meetings. These readings typically include principles of design, details of graphic production, data tables, definitions, examples, and practical applications of graphics and design pertaining to engineering.

Skills Demonstrations

None

Other assignments (if applicable)

None

Outside Assignments

Representative Outside Assignments

1. Assigned reading from the textbook typically amounting to 1 chapter a week. This will amount to 1 hour per week of reading.
2. Assigned conceptual, problem solving based, and project based homework that further explores and expands on the notions and techniques discussed throughout the course. Typically, homework will require 3 hours to fully complete and will be due on a weekly basis.

District General Education

A. Natural Sciences

B. Social and Behavioral Sciences

C. Humanities

D. Language and Rationality

E. Health and Physical Education/Kinesiology

F. Ethnic Studies/Gender Studies

CSU GE-Breadth

Area A: English Language Communication and Critical Thinking

Area B: Scientific Inquiry and Quantitative Reasoning

Area C: Arts and Humanities

Area D: Social Sciences

Area E: Lifelong Learning and Self-Development

Area F: Ethnic Studies

CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

IGETC

Area 1: English Communication

Area 2A: Mathematical Concepts & Quantitative Reasoning

Area 3: Arts and Humanities

Area 4: Social and Behavioral Sciences

Area 5: Physical and Biological Sciences

Area 6: Languages Other than English (LOTE)

Textbooks and Lab Manuals

Resource Type
Textbook

Description
Plantenberg, K. (2016). *Engineering Graphics Essentials* (5th). Mission SDC Publications.

Resource Type
Textbook

Description
Dix, M., Riley, P. (2016). *Discovering AutoCAD 2017*. San Francisco Pearchpit Press.

Resource Type
Textbook

Description
Shih, R.H. (2016). *SOLIDWORKS 2016 and Engineering Graphics - An Integrated Approach*. Mission SDC Publications.

Resource Type
Software

Description
AutoCAD. Autodesk Inc..

Resource Type
Software

Description
Solidworks. Dassault Systemes.

Resource Type
Other Instructional Materials

Description
Handouts.

Distance Education Addendum

Definitions

Distance Education Modalities
Hybrid (51%–99% online)
Hybrid (1%–50% online)
100% online

Faculty Certifications

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.
Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.
Yes

Regular Effective/Substantive Contact

Hybrid (1%–50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	The students will watch recorded lecture videos that go over the pertinent subject matter of the course.
Synchronous Dialog (e.g., online chat)	The students will join live, online meetings in which they will receive instruction, be reminded of all upcoming assignments/events, and be allowed to ask questions pertaining to the lecture and lab material. Recordings will be made available of all live meetings. Students may also be put into small groups to discuss a given class problem.

Asynchronous Dialog (e.g., discussion board)	Students will have access to a discussion board in which they can ask questions regarding the course material.
Face to Face (by student request; cannot be required)	Face to face meetings can be arranged when needed.

Hybrid (51%–99% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	The students will watch recorded lecture videos that go over the pertinent subject matter of the course.
Synchronous Dialog (e.g., online chat)	The students will join live, online meetings in which they will receive instruction, be reminded of all upcoming assignments/events, and be allowed to ask questions pertaining to the lecture and lab material. Recordings will be made available of all live meetings. Students may also be put into small groups to discuss a given class problem.
Asynchronous Dialog (e.g., discussion board)	Students will have access to a discussion board in which they can ask questions regarding the course material.
Face to Face (by student request; cannot be required)	Face to face meetings can be arranged when needed.

100% online Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	The students will watch recorded lecture videos that go over the pertinent subject matter of the course.
Synchronous Dialog (e.g., online chat)	The students will join live, online meetings in which they will receive instruction, be reminded of all upcoming assignments/events, and be allowed to ask questions pertaining to the lecture and lab material. Recordings will be made available of all live meetings. Students may also be put into small groups to discuss a given class problem.
Asynchronous Dialog (e.g., discussion board)	Students will have access to a discussion board in which they can ask questions regarding the course material.

Examinations

Hybrid (1%–50% online) Modality
Online
On campus

Hybrid (51%–99% online) Modality
Online
On campus

Primary Minimum Qualification
ENGINEERING

Review and Approval Dates

Department Chair
09/05/2020

Dean
09/05/2020

Technical Review
09/23/2020

Curriculum Committee
09/23/2020

DTRW-I
MM/DD/YYYY

Curriculum Committee
MM/DD/YYYY

Board
MM/DD/YYYY

CCCCO
MM/DD/YYYY

Control Number
CCC000599715

DOE/accreditation approval date
MM/DD/YYYY