Mt. San Jacinto College
Integrated Course Outline of Record

Form B

Submitted by: James Bae **Date:** 11/12/2020

Department	Subject	Course Number	Title
Engineering: Technologies	Engineering: Technologies ENGR	155	Computer Aided Drafting II

Units/Hours

Each lecture unit requires 1 hour per week of class time, and 2 hours per week of study outside of class.
Each laboratory unit requires 3 hours per week of class time.
Each activity unit requires 2 hours per week of class time and 1 hour per week of study outside of class.

Lecture Units	Lab Units	Total Units
2.00	1.00	3.00
Lecture Contact Hours	**Lab Contact Hours**	**Total Contact Hours**
32.00 - 36.00	48.00 - 54.00	80.00 - 90.00
Lecture Homework Hours	**Lab Homework Hours**	
64.00 - 72.00	0	

Stand Alone:

Program Applicable

AA/AS Degree General Ed Breadth Area(s):

-none-

General Education Justification:

Maximum Enrollment: 30

Maximum Enrollment Justification: Justification:

Grading Method: Letter Grade or P/NP

TOP code: 0953.00*

Can be Taken 1 **time(s) for credit** (max 4)

- [ ] - Visual or Performing Arts course that is required to meet major requirements for UC/CSU
- [ ] - Intercollegiate athletics course
- [ ] - Academic/vocational competition course

Catalog Description:

(Please do not refer to transferability or degree, certificate, or employment concentration applicability. Please only describe the course).
(**75 words** or less in gray box below).

This course provides students with the necessary skills for drafting careers in fields that employ architectural engineering drawings surveying, planimetric mapping, computer aided mapping skills such as Geographic Information Systems and Manufacturing. Applying cutting edge technology in the field of drafting students learn concepts of engineering drawing and drafting plans through digital manipulation of design elements. Exercises focus on coordinate geometry modeling programming and plotting.

Schedule Description:

(Please do not refer to transferability or degree, certificate, or employment concentration applicability. Please only describe the course).
(**25 words** or less in gray box below).

This advanced course in Computer Aided Drafting provides students the necessary skills in drafting for engineering fields that use engineer drawings, survey and planimetric mapping.

Need for the course:

This course provides the student with foundational skills to be immediately employable at an entry level in County and Commercial construction surveying and drafting. This may also support further education in Mechanical Engineering, Geographic Information System mapping and Environmental Engineering. It is one course of a series of courses required for a student to be awarded AS or Certificate in Engineering: Drafting Technology. The Center of Excellence for Labor Market Research (California Community Colleges) estimates that entry-level Engineering Technology jobs (Civil, Electrical, Industrial, Mechanical, amongst other Technicians) will continue to grow in the Inland Empire/San Bernardino area from 2018-2023 by 3%, while offering positions earning above estimated â€œliving wageâ€ rates. This estimated 300 annual jobs outpaced the awards given at the time by local community colleges. This indicates a major opportunity for MSJC to continue to provide entry level Engineering job training, while growing the program to more advanced training to support professional training in the future. This course is attached to and supports: ENGR - Engineering: Drafting Technology - Certificate (Required)

Prerequisite(s):

Prerequisites go through a separate approval process. See Forms E1-E6 for details.
(For further clarification, contact the Prerequisite Subcommittee)

- ENGR 154 with a Grade of C or better.

Corequisite(s):

Corequisites go through a separate approval process. See Forms E1-E6 for details.

-none-

Recommend Preparation:

Recommended Preparation goes through a separate approval process. See Forms E1-E6 for details.

-none-

Other Enrollment Criteria:

-none-

Learning Objectives:

(please number each objective and express in behavioral terms)

Upon the completion of the course the student will be able to do the following:

1. Manipulate and use rectangular 3D coordinate system to create a 3D drawing .
2. Construct a wireframe object.
3. Organize, manage, specify, change and create customized User Coordinate Systems in creating 3D drawings.
4. Create composite solids--Working with Booleans.
5. Create solid model extrusions and revolutions.
6. Construct details and features on solid models.
7. Illustrate and recognize the difference between a lofted and ruled surface.
8. Demonstrate mapping materials to objects.
9. Manipulate and use lighting based on global position.

Course Content:

(please number the outline of main topics and subtopics)

1. Three-dimensional construction and display
    1. Introduction to three-dimensional Drawing
        1. Rectangular 3d coordinate system to create a 3d drawing
        2. The right-hand rule of 3D drawing
        3. Viewports and layouts to display and print 3d drawings
        4. Wireframe objects
        5. Solid primitives
    2. Three dimensional Coordinates and constructions
        1. Specifying point position using spherical coordinate system. (Demonstrate how to locate 3D coordinate point placement by specifying its distance from the origin of the current UCS, its angle from the X axis (in the XY plane), and its angle from the XY plane).
        2. Specifying point positions using cylindrical coordinate system. (Point positions can be located within the CAD system by specifying its distance along and angle relative to the UCS X axis and its Z value perpendicular to the XY plane.
        3. Piping and 3D mapping drawings using the 3d polyline command
    3. Understanding User Coordinate Systems
        1. User Coordinate Systems in creating 3D drawings
    4. Using model space and layout space viewports to better visualize 3D objects.
        1. Drawing in multiple viewports
        2. Engineering layouts for maps and manufactured parts
        3. Dynamically change 3d views
2. Solid Model Construction and Editing
    1. Introduction to Solid Modeling
        1. Constructing Solid Primitives
        2. Create composite solids--Working with Booleans
            1. Subtracting solids from other solids
            2. Joining solids
            3. Making solids from intersections
    2. Solid Model Extrusions and Revolutions
        1. Solid model extrusions and revolutions
    3. Solid Modeling Details
        1. Changing object properties
        2. Aligning objects in 3D
        3. Rotating 3D objects within a drawing
        4. Mirroring 3D objects within a drawing
        5. Creating 3D arrays

6. Filleting a solid object
7. Chamfering on solid objects
8. Removing details and features

4. Solid Model Editing
    1. Editing faces, edges and bodies within a solid model
5. Create and edit a multi-view working detail and subassembly drawing of a multi-part object for use in the manufacturing industry
    1. Creating a bill of materials within a drawing

3. Surface Model Construction and Editing
    1. Introduction to Surface Modeling
        1. Drawing surface modeled primitives including:
            1. Box
            2. Sphere
            3. Cone
            4. Wedge
            5. Torus
            6. Pyramid
            7. Dome
            8. Dish
    2. Three-dimensional Surface Modeling Techniques
        1. Showing textures and elevations for use in the mapping industry
        2. The difference between a lofted and ruled surfaces
        3. Create a drawing of a map and airplane using surface modeling techniques
    3. Editing Surface Models
        1. Use grips to edit surface models
        2. How to trim and extend object in 3D
        3. Edit polygon meshes
        4. Employ fillets and rounds on surfaces
4. Rendering, Materials and Presentation Graphics
    1. Lights, Scenes and Rendering
        1. Rendering objects within AutoCAD
        2. Applying materials and lighting to a rendered scene
        3. Adjusting bitmap placement within AutoCAD
        4. Mapping materials to objects
    2. Advanced Lighting, Atmospheres, and Landscaping
        1. Applying a background within a drawing
        2. Using lighting based on global position
    3. Using Raster and Vector Graphics
        1. Compare raster and vector files
        2. Set image commands to manipulate inserted raster files
        3. Create an architectural drawing using a pre-approved sheet without changing legal requirements of structural content approvals (This involves a discussion of copy right laws within the architectural/structural engineering industry**)**

Lab Content:

(please number the outline of main topics and subtopics)

1. Three-dimensional construction and display
    1. Introduction to three-dimensional drawings
        1. Rectangular 3D coordinate system to create a 3D drawings
        2. The right-hand rule of 3D drawing
        3. Viewports and layouts to display and print 3D drawing
        4. Wireframe objects
        5. Solid primitives

2. Three dimensional Coordinates and constructions
    1. Specifying point position using spherical coordinate system. (Demonstrate how to locate 3D coordinate point placement by specifying its distance from the origin of the current UCS, its angle from the X axis (in the XY plane), and its angle from the XY plane).
    2. Specifying point positions using cylindrical coordinate system. (Point positions can be located within the CAD system by specifying its distance along and angle relative to the UCS X axis and its Z value perpendicular to the XY plane.
    3. Piping and 3D mapping drawings using the 3d polyline commands.
3. Understanding User Coordinate Systems
    1. User Coordinate Systems in creating 3D drawings
    2. Rectangular object
4. Using model space and layout space viewports to better visualize 3D objects.
    1. Drawing in multiple viewports
    2. Engineering layouts for maps and manufactured parts
    3. Dynamically change 3d views

2. Solid Model Construction and Editing
    1. Introduction to Solid Modeling
        1. Constructing Solid Primitives
        2. Create composite solids--Working with Booleans
        3. Subtracting solids from other solids
        4. Joining solids
        5. Making solids from intersections
    2. Create composite solids
        1. Solid Model Extrusions and Revolutions
            1. Solid model extrusions and revolutions
            2. Create solids
            3. Solid Modeling Details
            4. Changing object properties
            5. Aligning objects in 3D
            6. Rotating 3D objects within a drawing
            7. Mirroring 3D objects within a drawing
            8. Creating 3D arrays
            9. Filleting a solid object
            10. Chamfering on solid objects
            11. Removing details and features
            12. Construct details and features of solid models
        2. Solid Model Editing
            1. Editing faces, edges and bodies within a solid model
        3. Create and edit a multi-view working detail and subassembly drawing of a multi-part object for use in the manufacturing industry
            1. Creating a bill of materials within a drawing

3. Surface Model Construction and Editing
    1. Introduction to Surface Modeling
        1. Drawing surface modeled primitives including:
            1. Box
            2. Sphere
            3. Cone
            4. Wedge
            5. Torus
            6. Pyramid
            7. Dome
            8. Dish
    2. Three-dimensional Surface Modeling Techniques
        1. Showing textures and elevations for use in the mapping industry

2. The difference between a lofted and ruled surfaces
3. Illustrate
4. Recognize differences
5. Create a drawing of a map and airplane using surface modeling techniques

3. Editing Surface Models
    1. Use grips to edit surface models
    2. How to trim and extend object in 3D
4. Edit polygon meshes
5. Employ fillets and rounds on surfaces

4. Rendering, Materials and Presentation Graphics
    1. Lights, Scenes and Rendering
        1. Rendering objects within AutoCAD
        2. Applying materials and lighting to a rendered scene
        3. Adjusting bitmap placement within AutoCAD
        4. Mapping materials to objects
    2. Advanced Lighting, Atmospheres, and Landscaping
        1. Applying a background within a drawing
        2. Using lighting based on global position
    3. Using Raster and Vector Graphics
        1. Compare raster and vector files
        2. Set image commands to manipulate inserted raster files
        3. Create an architectural drawing using a pre-approved sheet without changing legal requirements of structural content approvals (This involves a discussion of copy right laws within the architectural/structural engineering industry).

Methods of Instruction:

Methods of instruction may include, but are not limited to the following:

- **Method:** Lecture
  Integration: Lecture will be used to present terminology, software user interface, application of CAD in engineering fields and its capabilities.
- **Method:** Hands on activities including lab assignments.
  Integration: Hands on activities including lab assignments will include: 1. Using the CAD system, construct a drawing using simple primitives of a table and a lamp. 2. Construct a 3D Wireframe drawing of a drill press bracket 3. Apply proper lighting and camera positions for a 3D Wireframe shaded object.
- **Method:** Readings/Supplemental Material
  Integration: Reading will be used as supplemental material in explaining current and emerging technology and drafting practices: 1. How to apply materials to a part. 2. How to create three-dimensional objects. 3. The different types of object surfaces.
- **Method:** Computer work
  Integration: In the computer lab students will; 1. Experiment with changing lighting and camera positions within a rendered scene. 2. Experiment with changing color and shading within a rendered scene.
- **Method:** Observation and Demonstration
  Integration: Demonstration of and examples on how to use the CAD software to show the purpose of functions and how to use them to manipulate drawings.

Methods of Evaluation:

A student's grade shall be determined by the instructor using multiple measures of performance related to the course objectives. Methods of evaluation may include but are not limited to the following:

- **Method:** Evaluate hands-on competency for accuracy and efficiency
  Integration: Assessment of students accuracy and efficiency, by the following drawings. Students will be assessed on their ability to find and apply the design elements in the software to their design assignments. 1.Piping drawing using the 3D polyline command 2.Multi-view working detail and sub-assembly drawing of a

multi-part object 3.Topographic mapping drawing 4.Drawing of an airplane 5.Rendered presentation drawing 6.Edited bitmap sheet drawing

- **Method:** Assessment of competency
  Integration: Students will be assessed in achieving Computer Aided Drafting software component creation. Students will be assessed on their ability to find and apply the design elements in the software to their design assignments.
- **Method:** Class Work
  Integration: Assess students grasp and understanding on material being covered. Students will be assessed on their ability to find and apply the design elements in the software to their design assignments.
- **Method:** Exams/Tests
  Integration: Assess students on the material presented including the advanced usage of the computer aided drafting program to create and modify designs within CAD. Students will be assessed on their ability to find and apply the design elements in the software to their design assignments.

Examples of Assignments:

Students will be expected to understand and critique college level texts or the equivalent. Reading and writing, as well as out of class assignments are required. These assignments may include but are not limited to the following:

1. Construct a three dimensional mash to show textures and elevations for use in the mapping industry.
2. Create a drawing of a map and airplane using surface modeling techniques.
3. Create drawings using different materials and lighting within a rendered scene.
4. Create an appealing presentation drawing for use in the manufacturing, mapping or architecture industries using the techniques presented in the presentation graphics section of the class.
5. Create an architectural drawing using a pre-approved sheet without changing legal requirements of structural content approvals (This involves a discussion of copy right laws within the architectural/structural engineering industry).
6. Students will create the following drawings:
    1. Piping drawing using the 3D polyline command
    2. Multi-view working detail and subassembly drawing of a multi-part object
    3. Topographic mapping drawing
    4. Drawing of an airplane
    5. Rendered presentation drawing
    6. Edited bitmap sheet drawing

Textbooks:

- Omura, G., Benton, B. (2014). *Mastering AutoCAD 2014 and AutoCAD LT 2014: Autodesk Official Press* Sybex. ISBN: 9781118575048
- Shumaker, T., Madsen, D. (2014). *AutoCAD and Its Applications Basics 2014* Goodheart-Willcox. ISBN: 9781619604469
- Omura, G., B. Benton (2018). *Mastering AutoCAD 2019 and AutoCAD LT 2019 1st Edition* Sybex. ISBN: 1119495008
- Shumaker, T., D. Madsen (2019). *AutoCAD and Its Applications Basics 2020 Twenty-seventh Edition* Goodheart-Willcox. ISBN: 163563864X

Other Resources:

Minimum Qualification

- Engineering (Masters Required) **or**
- Engineering Support **or**
- Engineering Technology (Masters Required)