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Course Outline for ENGR 22

ENGINEERING DESIGN GRAPHICS

Effective: Fall 2006

I. CATALOG DESCRIPTION:

ENGR 22 — ENGINEERING DESIGN GRAPHICS — 3.00 units

Introduction to the engineering-design process, and to technical graphic communications tools used by engineers. Conceptual design of products. Development of spatial reasoning skills. Orthographic and axonometric projection-drawing techniques. Tolerance analysis for fabrication. Documentation of designs through engineering working drawings. Use AutoCAD Computer-Assisted Drawing software as a design tool. Basic CAD 3-Dimensional solid-modeling. Strongly recommended: Mathematics 38 or 36Y, and English 1A or 52A. 2 hours lecture, 3 hours laboratory.

2.00 Units Lecture 1.00 Units Lab

Grading Methods:

Letter Grade

Discipline:

	<u>MIN</u>
Lecture Hours:	36.00
Lab Hours:	54.00
Total Hours:	90.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT:

III. PREREQUISITE AND/OR ADVISORY SKILLS:

IV. MEASURABLE OBJECTIVES:

Upon completion of this course, the student should be able to:

1. explain the engineering design process
2. demonstrate use of drafting instruments
3. develop technical sketches
4. use proper lettering technique
5. demonstrate through drawing the use of line construction
6. demonstrate use of computer aided drawing (CAD) tools
7. demonstrate and discuss visualization techniques
8. apply engineering geometrics
9. construct graphic construction, e.g., planes, angles, surfaces
10. construct axonometric projections
11. construct perspective projections
12. construct auxiliary views
13. construct section views
14. dimension drawings with a basic knowledge of tolerances
15. describe the fundamental concept of geometric dimensioning and tolerancing (gd&t)
16. define and explain thread and fastener applications
17. define and apply working drawings
18. strengthen ability to analyze spatial relationships
19. solve three-dimensional problems by descriptive geometry techniques

V. CONTENT:

- A. Use of traditional and computer-aided design (CAD) tools
 1. Scales, triangles, protractors, compasses
 2. CAD command syntax, sequence, and function
 3. Drawing strategy and file management
- B. Design visualization
 1. Lettering and alphabet of lines
 2. Sketches
 3. Models
- C. Developing orthographic projections
 1. One-view drawings
 2. Two-view drawings
 3. Three-view drawings
 4. Technical sketches

- 5. Auxiliary views
- 6. Section views
- D. Developing pictorial projections
 - 1. Isometric projection
 - 2. Oblique projection
 - 3. Single-point perspective
 - 4. Two-point perspective
- E. Using graphic construction
 - 1. Planes
 - 2. Angles
 - 3. Surfaces
 - 4. Lines
- F. Dimensions
 - 1. Application to orthographic and axonometric projections
 - 2. Tolerancing
 - 3. Geometrical dimensioning/positioning and tolerancing overview
 - 4. Detail, subassembly and assembly review drawings
- G. Working drawings
 - 1. Detail drawings
 - 2. Sub-assembly drawings
 - 3. Assembly drawings
 - 4. Parts lists
 - 5. Review actual working drawings
- H. Piercing points
 - 1. Auxiliary view method
 - 2. Two-view method
- I. Intersection of planes
 - 1. Piercing point method
 - 2. Auxiliary view method
 - 3. Cutting plane method
- J. Angle between planes
 - 1. Dihedral angle – given line of intersection
 - 2. Dihedral angle – line of intersection not given
- K. Vectors
 - 1. Resultant of concurrent coplanar vectors
 - 2. Resolution of a vector into concurrent coplanar components
 - 3. Resultant of concurrent non-coplanar vectors
 - 4. Resolution of a vector into concurrent non-coplanar components
 - 5. Velocity vectors
- L. Intersection of planes with solids
 - 1. Plane and pyramid intersection
 - 2. Plane and right circular cone intersection
 - 3. Plane and prism intersection
 - 4. Plane and cylinder intersection
- M. Developments
 - 1. Development procedures
 - a. Radial line
 - b. Parallel line

VI. METHODS OF INSTRUCTION:

- A. **Demonstration** - Computer demonstration
- B. **Lecture** -
- C. **Discussion** - Review of and discussion about actual engineering drawings and designs 1. Reading from the text and handouts 2. Completion of tutorial exercises 3. Group problem solving exercises 4. Homework assignments, i.e., producing drawings and sketches using CAD and/or sketches, and constructing three-dimensional physical models 5. In-class use of drafting equipment and computers

VII. TYPICAL ASSIGNMENTS:

A. Reading: 1. Read "Dimensioning," Chapter 15, Technical Graphics Communication, and be prepared to discuss how complete dimensions are applied to a drawing. B. Practical Exercises: 1. Read "Angle Between Two Planes," Chapter 12, Technical Graphics Communication, and be prepared to determine the angle between two intersecting planes. C. Drawings: 1. Sketching and lettering 2. Geometric construction 3. Multiview drawings 4. Assembly drawings 5. Section drawings 6. Toleranced drawings 7. Auxiliary view drawings 8. Perspective drawings 9. Axonometric projection drawings

VIII. EVALUATION:

A. **Methods**

- 1. Exams/Tests
- 2. Class Participation
- 3. Home Work
- 4. Other:
 - a. Methods:
 - 1. Assignments (to be graded at the instructor's discretion)
 - 2. Class participation
 - a. Topic discussions
 - b. Homework discussions
 - 3. Examinations
 - a. Quizzes
 - b. Midterms
 - b. Typical Problems
 - 1. Drawing exercises using layout A-2, draw mechanically or on CAD the given views and add the missing lines as shown in Figure 4.86B. (Assignment)
 - 2. Establish a line through point "O" parallel to plane xyz and intersection line MN. (Quiz Problem)
 - 3. Construct a triangle having sides with the following lengths: 2", 3" and 4.5". Bisect the three interior angles. The bisectors should meet at a point. Draw the inscribed circle with the point as center. Show construction lines. (Exam Problem)
 - 4. Draw detail and assembly drawings from isometric drawing figure 19.41. Dimension views as appropriate. (Assignment)

5. CAD problems: Refer to drawing Pattern1 on CAD system and calculate the total surface area with the 3 holes removed. (Assignment)
6. Drawing problems: Draw an orthographic projection of Fig. 1 (isometric drawing) without dimensions. (Exam Problem)
7. Visualization problems: Study each object, matching it with target shape, noting the orientation of the beveled edge. (Quiz Problem)?

B. Frequency

1. Weekly assignments
 - a. Drawings/sketches/check out text CAD tutorials
 - b. Problem analysis
2. Minimum of two midterm examinations
3. Quizzes as needed

IX. TYPICAL TEXTS:

1. Bertoline, Wiebe *Technical Graphics Communication*. 3rd ed., McGraw Hill, 2003.
2. Kalameja, Alan J. *The AutoCAD Tutor for Engineering Graphics*., AutoDesk Press (ITP), 1998.
3. James D. Bethune *Engineering Graphics with Auto CAD 2004 with 180 Day Auto CAD Software Package*., Prentice Hall, 2004.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

- A. Drafting instruments (e.g. triangles, scales, compass, circle template, drafting pencils, protractor, etc.)
- B. Floppy or external data storage device