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Course Outline for DSNT 61

ELECTRONIC DESIGN

Effective: Fall 2002

I. CATALOG DESCRIPTION:

DSNT 61 — ELECTRONIC DESIGN — 3.00 units

Preparation of electrical and electronic drawings using standard graphical symbols and annotation currently utilized in industry, including wiring, cable, interconnecting, logic, and schematic diagrams. Introduction to printed circuit board layout and design using CAD and surface mounting technology.

1.50 Units Lecture 1.50 Units Lab

Prerequisite

DSNT 62A - Computer Aided Drafting (CAD)

Grading Methods:

Letter Grade

Discipline:

	MIN
Lecture Hours:	27.00
Lab Hours:	81.00
Total Hours:	108.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

Before entering the course a student should be able to:

A. DSNT62A

1. identify CAD hardware and use it effectively to input drawing information;
2. use Windows Explorer to format disks and perform disk file manipulations such as copying, deleting, and finding files and folders;
3. develop preliminary planning strategies and sketches to optimize CAD efficiency;
4. set up drawing formats, use drawing aids, and apply display options productively;
5. construct accurate geometric shapes using absolute, relative and polar entry methods;
6. use object snap options effectively to create additional geometry on-the-fly;
7. determine command sequence required to select text style and placement;
8. select appropriate basic and advanced editing commands to modify existing entities;
9. construct and utilize layers, colors, and line types;
10. create and manage layouts, compatible with typical printer/plotter output devices;
11. utilize on-screen menu systems effectively;
12. create multiple patterns of drawing components;
13. obtain information about entities on the drawing;
14. construct multiview layouts with auxiliary views.

IV. MEASURABLE OBJECTIVES:

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

- A. explain the need for drawing quality and demonstrate how the computer and traditional tools are used to attain a high standard of legibility;
- B. describe the purpose and function of electronic and electrical components;
- C. draw a block, flow, and/or single line diagram, illustrating preferred practices;
- D. list the qualities of a good schematic and draw a schematic from an engineer's sketch;
- E. understand how schematic layout is a reflection of circuit function;
- F. correctly apply component symbology, reference designations, abbreviations, component values, and other appropriate electronic terminology to a drawing;
- G. draw a logic diagram and interpret the logic symbols;
- H. understand wiring methods and be able to make selection decisions based on quantity and complexity;
 - I. create a wiring list or other wiring documents, complete with annotation for the assembler;
 - J. draw a point-to-point, highway, and /or interconnection diagram;
 - K. draw a cable and/or harness assembly drawing with proper wire terminal identification method;
 - L. lay out a printed circuit board and create artwork masters;

- M. create a drill drawing and a printed circuit board assembly drawing;
- N. explain the process for etching printed circuit boards;
- O. recognize the influence of CAD in the design process from development, through printed circuit board layout, to generation of service handbooks;
- P. complete an integrated multi-drawing package from a schematic or sketch;
- Q. demonstrate an understanding of the job description for industrial electrical/electronic designers.

V. CONTENT:

- A. Equipment, instruments, and materials
 - 1. Computers to automate and integrate
 - a. Hardware and electronic design CAD software
 - b. Input and output devices
 - c. Computer-aided manufacturing
 - d. CAD/CAM Robotic applications
 - 2. Traditional tools and materials
 - 3. Lettering and lettering devices
 - 4. Occupational options and trends
- B. Fundamentals of Electronics
 - 1. Electron flow and atomic theory
 - 2. Electrical and electronic symbols
 - 3. Device and component symbols
 - a. Component specifications and reference designations
 - b. Component abbreviations
 - c. Reference standards
 - 1. American National Standards Institute (ANSI) Y32.2
 - 2. Military Standards (MIL-STD)
 - 3. Institute of Electrical and Electronics Engineers (IEEE)
 - 4. Joint Industrial Council (JIC)
 - 4. Device and component function
 - a. Electrical quantities-voltage, current, and resistance
 - b. Electrical circuits-Ohm's Law
 - 5. Line techniques
- C. Schematic Diagrams-functional relationship between components
 - 1. Layout techniques
 - a. Line and dot connections
 - b. Balance of lines and spaces
 - c. Signal flow
 - d. Technical data accuracy and placement
 - e. Use of interrupted lines
 - f. Switch configurations and documentation
 - g. Scale, grouping, and space estimations
 - h. Graphic symbol alignment and placement
 - 2. Construction of drawing
 - a. Dominant positioning of active components
 - b. Sequence of construction
 - c. CAD-generated diagrams
 - 1. Establishment of a symbol library
 - 2. Attribute creation and extraction
 - 3. Drawing verification
- D. Logic symbology, diagrams, and annotation
 - 1. Rules of Logic diagrams
 - 2. Truth symbols and Logic symbols
 - 3. Constructing Logic symbols
 - 4. Combination Logic systems
 - 5. Layout techniques
 - a. Flow lines
 - b. Logic and computers
- E. Block Diagrams
 - 1. Types and uses of block diagrams
 - 2. Construction of block diagram
 - a. Determination of shape and size of blocks
 - b. Symbology and layout
 - c. Flow line strategy, connections, crossovers
 - d. Lettering considerations
- F. Control Circuit Components
 - 1. Control and protective devices, switches, and starters
 - 2. Types of diagrams - one-line and ladder
- G. Wiring Diagrams
 - 1. Wire Primer
 - 2. Parts of a wiring diagram
 - 3. Types of diagrams - continuous, interrupted, tabular
 - 4. Cables and Harnesses
 - 5. Diagram Construction
- H. Printed Circuit Board Design
 - 1. Processes and materials
 - 2. Printed Circuit Documentation
 - 3. PCB Fabrication utilizing thru hole and surface mount technology
 - 4. PCB Layout
 - a. Content
 - b. Preliminary considerations
 - c. Design techniques
 - 5. PCB Design Using CAD

VI. METHODS OF INSTRUCTION:

- A. Textbook Readings
- B. Device, component and PCB samples
- C. Website referencing
- D. **Demonstration** -
- E. **Demonstration** - Computer demonstration

F. Lecture -

VII. TYPICAL ASSIGNMENTS:

A. Reading: 1. Read pgs. 192-204 on Schematic diagrams from Drafting for Electronics, noting the do's and don'ts of layout practices. 2. Reference website <http://webhome.idirect.com/~jadams/electronics/identify2.htm> for information on diodes, LED's and IC's. B. Drawings and/or workbook plates: 1. Draft by hand or computer-generate a point-to-point wiring diagram for the pictured text simulator assembly drawing. Reference component drawings for component front panel of the test simulator to assure compatibility. Use the wiring list generated previously to aid in this problem. All wire lengths are determined at assembly. Note: Wiring is installed with panel turned upside down. 2. 2. With the use of a template, construct two, three, four, and eight input OR gates. Remember to draw extension lines on the input side of the symbols for added space of flow lines. 3. 3. Complete Plate 10 of the Block diagram. C. Projects or multi-drawing packages: 1. Complete a flow chart, schematic, parts list, and assembly for the power supply. 2. Provide a series of documentation drawings including a schematic, layout sketch and master, marking master, artwork master, drill master/drill table, master drawing/parts list, and assembly drawing. Each project is to be completed at 2:1 or 4:1 scale as assigned.

VIII. EVALUATION:

A. **Methods**

B. **Frequency**

1. Frequency:
 - a. Weekly assignments
 - b. 1 or more projects or drawing packages
 - c. 1 Midterm, 1 Final examination
 - d. Quizzes as needed

IX. TYPICAL TEXTS:

1. Lamit, Gary and Lloyd, Sandra J. *Drafting for Electronics*. 2nd ed., Prentice Hall, 1993.
2. Baer & Ottaway *Electrical and Electronic Drawing*., McGraw Hill Book Company, 0.
3. Graphic Symbols for Electrical & Electronics Diagrams (ANSI Y32.2), Institute of Electrical and Electronic Engineers.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

- A. Computer use certificate
- B. Drafting equipment
- C. Five 3 1/2" diskettes