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**Course Outline for DSNT 66B**  
**ELECTRO-MECHANICAL DESIGN**  
**Effective: Spring 2014**

**I. CATALOG DESCRIPTION:**

DSNT 66B — ELECTRO-MECHANICAL DESIGN — 3.00 units

Continuation of mechanical design principles with the addition of electronic/electrical concepts. Part design with concentration on the flow and interaction between manufacturing and design, documentation, revision systems, Engineering change orders and requests, complex drawing and notation of entire systems. Also includes résumé, portfolio, and interview preparation, career opportunities, skills and attitudes necessary to succeed in industry.

1.50 Units Lecture 1.50 Units Lab

**Prerequisite**

DSNT 61 - Electronic Design  
and

DSNT 66A - Mechanical Design Concepts

**Grading Methods:**

Letter Grade

**Discipline:**

	<b>MIN</b>
<b>Lecture Hours:</b>	27.00
<b>Lab Hours:</b>	81.00
<b>Total Hours:</b>	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. DSNT61
- B. DSNT66A

**IV. MEASURABLE OBJECTIVES:**

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

- A. contribute to a team's progress in identifying and defining design parameters and considerations;
- B. interpret the criteria for product and manufacturing engineering that results in design for manufacturability;
- C. analyze and utilize the stages involved in the design process while recognizing their flexibility;
- D. develop an understanding of critical-path scheduling and just-in-time production concepts;
- E. utilize full gamut of information sources for designers including standards, technical reports, handbooks, references, patents, published papers, registers, tables, vendor catalogs, and specialized search engines and websites;
- F. protect the sanctity of the design database, especially within CAD applications;
- G. describe flow of design parts, manufacturing, implementation and documentation;
- H. demonstrate familiarity with the process of automated and computer-aided manufacturing;
- I. sketch and detail entire assembly with proper notations and form proper revisions;
- J. realize that revisions are a necessary part of design process and their inevitability can be prepared for by developing a healthy mental recovery strategy;
- K. demonstrate familiarity with the associative dimensioning capabilities of CAD;
- L. demonstrate an understanding of the job description and the skills needed;
- M. show awareness of the opportunities for Design Technology careers and advancement.

**V. CONTENT:**

- A. Review of Design Process
  - 1. Design Considerations
    - a. Function
    - b. Constraints
    - c. Materials
    - d. Aesthetics

- e. Environmental effects and safety requirements
  - f. Durability and Reliability
  - g. Interchangeability and standardization
  - h. Maintenance and service
  - i. Costs
- 2. Stages to Design Process
  - a. Problem identification or recognition of a need
  - b. Conceptualization of creative solutions
  - c. Evaluation and refinement of preliminary ideas
  - d. Analysis of proposed solutions
  - e. Design choice and product or system decisions
  - f. Development and implementation of design
  - g. Production, manufacturing, and packaging
  - h. Marketing, sales, and distribution
- 3. Skills of a successful designer
  - a. Possession of creative instincts
  - b. Inquisitive mind
  - c. Good communication skills - verbal, written, graphic
  - d. Understand principles of design
  - e. Ability to integrate and balance several ideas and solutions
  - f. Ability to do self-evaluation
  - g. Good concentration and visualization skills
  - h. Ability to think and communicate in 3-D
  - i. Good mathematical skills
- B. Working drawings and assembly drawings
  - 1. Format and documentation
  - 2. Outline, sectioned, pictorial assemblies
  - 3. Working Assembly drawing
  - 4. Engineering change orders
  - 5. Drawing notes and specifications
  - 6. Reprographics
    - a. Drawing storage
    - b. Reproduction techniques
    - c. Digital technologies
- C. Tolerance studies
  - 1. Interchangeability
  - 2. Representations
  - 3. Fit types and determination
  - 4. Using the Machinery's Handbook
  - 5. Functional dimensioning
- D. Quality control
  - 1. ISO 9000/9001 Standards
  - 2. Inspection tools
    - a. Surface plate
    - b. Height gages
    - c. Calipers, Micrometers
    - d. Precision spindle, centers, dial indicator
    - e. Coordinate measuring machine
  - 3. Inspection processes
    - a. Functional gaging
    - b. Open gaging
    - c. CMM gaging
- E. Hydraulic system components
  - 1. O-Rings
    - a. Types and Function
    - b. Determining tolerancing
  - 2. Valves
- F. Mechanisms: Gears, Cams, Bearings, and Linkages
  - 1. Gears
    - a. Classifications
    - b. Parallel, Intersecting, and Nonintersecting Shafting
    - c. Gear Teeth geometry
    - d. Gear and Pinion Ratios
    - e. Spur gears-definition, formula, graphical representation
    - f. Racks, Worm gears, Bevel gears
  - 2. Cams
    - a. Cam and Follower types
    - b. Displacement diagrams
    - c. Motion types and diagrams
    - d. Cam Profile
  - 3. Linkages
    - a. Symbols, types, analysis
  - 4. Bearings
    - a. Plain and Rolling contact Bearings
    - b. Graphical Representations
- G. Piping Drawings
  - 1. Pipe types and materials
  - 2. Pipe connections
  - 3. Pipe fittings
  - 4. Valves
  - 5. 3-D piping diagrams
- H. Jigs and Fixtures
  - 1. Function
  - 2. Design Considerations
- I. Automated Manufacturing Processes (CIM)
  - 1. Computer-aided manufacturing
  - 2. Numerical control
  - 3. Robotics
  - 4. Design for Manufacturability
- J. Analysis of Job Qualifications and Résumé Preparation

- K. Salary expectations, working conditions, future trends in Design Technology
- L. Advancement opportunities and related fields
- M. Job search, portfolio and interview preparedness

#### VI. METHODS OF INSTRUCTION:

- A. **Field Trips** - Field trips and site observation as needed
- B. Practical examples
- C. **Lecture** -
- D. **Guest Lecturers** - Guest speakers with specific expertise
- E. **Lab** - Independent laboratory project assignments
- F. **Lab** - Collaborative laboratory project assignments
- G. **Discussion** - Team discussion and problem solving
- H. **Demonstration** -

#### VII. TYPICAL ASSIGNMENTS:

A. Reading: 1. Read pgs. 632-662 on Design Process in preparation for creating a flow chart to organize the tasks and personnel assignments for your design project. 2. Read pgs. 1028-1043 on Gears and list the classification of gears. B. Homework: 1. Create a single-line drawing of the process flow diagram shown on page 1105 of textbook. 2. Design a drill jig to drill the four holes shown in the flanged adapter pictured below. Both ends of the part and the holes have been finished. Include a bill of material and call out all standard parts. B. Projects/Problem-solving: 1. From the following information, use the ANSI standards to create a detail drawing of a bevel gear: Diametral pitch = 4, Pressure angle = 20 degrees, Teeth = 36, Face width = 2", Shaft diameter = 1", keyway for #406 Woodruff key. 2. Wheel pullers are used to remove cams, pulleys, gears, wheels, and so on, which have been tightly mounted on a shaft. Design a wheel puller with three hook clamps that will fasten onto an outer edge of a part to be removed. Include a pressure screw that bears against the end of a shaft. In operation as the pressure screw is turned, the screw should push against the shaft, causing the legs to pull the part away from its shaft. Prepare a design layout, a set of detail drawings, a brief written statement explaining its function, and a working assembly drawing. Select suitable materials, manufacturing processes, and hardware.

#### VIII. EVALUATION:

##### A. **Methods**

##### B. **Frequency**

- 1. Frequency:
  - a. Weekly graded assignments
  - b. One or more multi-drawing projects
  - c. One collaborative, semester-long project
  - d. One midterm and one final examination

#### IX. TYPICAL TEXTS:

- 1. Lamit, Gary *Technical Drawing and Design.*, West Publishing Company, 1994.
- 2. Jensen, Helsel, and Short *Engineering Drawing and Design.* 5th ed., Glencoe, McGraw-Hill, 1996.
- 3. Giesecke, Mitchell, Spencer, Hill, Dygdon, Novak *Technical Drawing.* 10th ed., Macmillan Publishing Company, 2000.
- 4. Bertoline, Wiebe, Miller, & Mohler *Technical Graphics Communication.* 2nd ed., McGraw-Hill, 1997.
- 5. Rowh, Mark *Opportunities in Drafting Careers.*, NTC Publishing Group, 1994.

#### X. OTHER MATERIALS REQUIRED OF STUDENTS:

- A. Computer use certificate
- B. Zip disk or several 3 1/2" diskettes