Northport High School

Design and Drawing for Production (PLTW) SYLLABUS

Teacher: **Mr. Robinson**
Year: **2010-2011**
Room: **L-224 – CAD Lab**

Course Description:
Introduction to Engineering Design or Design and Drawing for Production (DDP) is a foundation course in the Technology Department's Engineering and Technical Drawing Sequence that teaches students problem-solving skills using the design and production process. Hands-on labs and Inventor design software from Autodesk are used as learning tools for students to design and produce projects related to industry. This course articulates for college credit with Rochester Institute of Technology.

Course Expectations:
Students will demonstrate:

- an ability to apply knowledge of mathematics, science, and engineering
- an ability to design and conduct experiments, as well as to analyze and interpret data
- an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- an ability to function on multi-disciplinary teams
- an ability to identify, formulate, and solve engineering problems
- an understanding of professional and ethical responsibility
- an ability to communicate effectively
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- a recognition of the need for, and an ability to engage in life-long learning
- a knowledge of contemporary issues
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Grading Policy
You're final grade each marking period will be based on the following

- 10% Participation
- 20% Written Assignments
- 20% Tests and Quizzes
- 50% Major Projects

Engineering Notebook
You will be required to maintain an Engineering Notebook. This notebook will be a reflection of all of your efforts and progress in this course. The notebook will be divided into sections and must be kept neat and organized. Your engineering notebook will be checked at the conclusion of every week and should be kept up to date.

Missing Work
You are responsible for any work that you miss if you are absent. It is important that you see the teacher or ask a peer about any missing work when you return to school. This is your responsibility.

Final Exam
There will be a final examination at the conclusion of this course. The exam will be based on all topics covered during the course of the year.

Required Materials
- Pen and Pencil
- 1-1/2" Binder
- Dividers
- Paper
- Lined Paper (College Ruled)
- Engineer's Notebook

Sample Course Activities/Projects/Assessments:
- Engineering Notebook and Journal
- Problem solving activities
- Project presentations
- 3-D Design software applications
- Virtual Design Challenge

Course Outline:

Unit 1: Design Process (10 weeks)
Lesson 1.1 Introduction to a Design Process **(11 days)**
- 1.1.1 Basic Design Tools
- 1.1.2 Introduction to Research
- 1.1.3 Modeling

Lesson 1.2 Introduction to Technical Sketching and Drawing **(11 days)**
- 1.2.1 Basic Line Conventions
- 1.2.2 Pictorial Sketches
- 1.2.3 Introduction to Multiview Drawings

Lesson 1.3 Measurement and Statistics **(10 days)**
- 1.3.1 History of Measurement
- 1.3.2 English and Metric Linear Measurements
- 1.3.3 Dial Caliper Measurement

- 1.3.4 Linear Dimensions
- 1.3.5 Applied Statistics

Lesson 1.4 Puzzle Cube **(17 days)**

- 1.4.1 Puzzle Design Challenge
- 1.4.2 Puzzle Part Combinations
- 1.4.3 Packaging Design
- 1.4.4 Marketing

Unit 2: Design Exercises (10 weeks)

Lesson 2.1 Geometric Shapes and Solids **(10 days)**

- 2.1.1 Geometric Shapes
- 2.1.2 Geometric Solids
- 2.1.3 Calculating Area
- 2.1.4 Calculating Properties
- 2.1.5 CAD Fundamentals

Lesson 2.2 Dimensions and Tolerances **(9 days)**

- 2.2.1 Dimensioning Conventions
- 2.2.2 Tolerancing

Lesson 2.3 Advanced Modeling Skills **(19 days)**

- 2.3.1 Parameters
- 2.3.2 Auxiliary Views
- 2.3.3 Section Views
- 2.3.4 Feature-Based Solid Modeling
- 2.3.5 Assembly Modeling
- 2.3.6 Assembly Drawing Standards
- 2.3.7 Exploding Assemblies
- 2.3.8 Assembly Animation

Lesson 2.4 Advanced Designs **(12 days)**

- 2.4.1 Advanced Designs
- 2.4.2 Design Process
- 2.4.3 Teamwork
- 2.4.4 Decision Matrix
- 2.4.5 Revision Blocks
- 2.4.6 Assembly Drawing Standards

Unit 3: Reverse Engineering (9 weeks)

Lesson 3.1 Visual Analysis **(8 days)**

- 3.1.1 Visual Design Elements
- 3.1.2 Visual Design Principles
- 3.1.3 Composition
- 3.1.4 Advertising
- 3.1.5 Graphic Design

Lesson 3.2 Functional Analysis **(4 days)**

- 3.2.1 Identifying Subsystems
- 3.2.2 System Analysis

Lesson 3.3 Structural Analysis **(15 days)**

- 3.3.1 Structural Connections
- 3.3.2 Precision Measurement

- 3.3.3 Material Analysis
- 3.3.4 Property Analysis

Lesson 3.4 Product Improvement By Design **(16 days)**

- 3.4.1 Researching Product History and Evolution
- 3.4.2 Product Innovation
- 3.4.3 Problem Identification
- 3.4.4 Writing a Design Brief
- 3.4.5 Brainstorming
- 3.4.6 Design Critique
- 3.4.7 Technical Report

Unit 4: Open-Ended Design Problems (7 weeks)

Lesson 4.1 Engineering Design Ethics **(8 days)**

- 4.1.1 Human Impacts
- 4.1.2 Product Lifecycle
- 4.1.3 Recycling
- 4.1.4 Design For Disassembly (DFD)
- 4.1.5 Environmental Protection Agency (EPA)
- 4.1.6 Occupational Safety and Health Administration (OSHA)

Lesson 4.2 Design Teams **(25 days)**

- 4.2.1 Teamwork
- 4.2.2 Project Planning
- 4.2.3 Assessment
- 4.2.4 Meetings
- 4.2.5 Virtual Teams

Course Curriculum MAP:

Unit 1 Design Process 47 hours	Unit 2 Design Exercise 50 hours	Unit 3 Reverse Engineering 43 hours	Unit 4 Open-Ended Design Problems 33 hours
Intro to Design Process – 11 hours	***Geometric Shapes and Solids – 10 hours***	***Visual Analysis – 8 hours***	***Engineering Design Ethics – 8 hours***
Intro to Technical Sketching & Drawing – 11 hours	***Dimensions and Tolerances – 9 hours***	***Functional Analysis – 4 hours***	***Design Teams – 25 hours***
Measurement and Statistics – 10 hours	***Advanced Modeling Skills – 10 hours***	***Structural Analysis – 15 hours***	
Puzzle Cube – 17 hours	***Advanced Designs – 12 hours***	***Product Improvement By Design – 16 hours***	

Lesson Protocol:

- Bell Ringer Activity: Anticipatory Activity or review of previous learning
- Teacher Input
  - Check for understanding
- Teacher Models steps/processes
  - Check for understanding
- Guided Practice: Students apply steps/processes with guidance
  - Check for understanding
- Independent Practice: Students work in teams or independently to complete project
- Closing Activity: summarize learning and final check for understanding

Course Power Vocabulary:

absolute coordinates
accuracy
acute triangle
adhesive
adhesive bonding
advertise
aesthetic
aligned dimension
analysis
angle
annotate
area
arrowheads
assembly
assembly drawing
asymmetry
auxiliary view
axis
balance
balloons
baseline dimensioning
bilateral tolerance
black box model
blind hole
break line
broken-out section
by-product
cabinet oblique drawing
cabinet oblique sketch
caliper
Cartesian coordinate system
cavalier oblique drawing
cavalier oblique sketch
centerline
chain dimensioning

chamfer
circle
circumscribe
class interval
clearance fit
component
compound machine
compression
Computer-Aided Drafting (CAD)
constraint
construction line
contrast
convert
counterbore
countersink
criteria
critique
cube
cutting plane line
cylinder
decision matrix
degree
degree of freedom
depth
descriptive abstract
design
design brief
design process
design statement
designer
detail drawing
diameter
dimension
dimension lines
documentation
dual dimensions
ellipse
emphasis
engineer
ergonomics
exploded assembly
extension
extrusion
fastener
fillet
fluid power
foreshorten
full section
GANTT chart
geometric constraint
graphic design
grid
half section
hidden line
histogram
hydraulics
innovation
interference
isometric drawing
joinery
juxtapose
mock-up
object line
oblique drawing
obtuse triangle
orthographic projection
parallelogram
parameter
phantom line
polygon
precision
quadrilateral
radial symmetry
removed section
reverse engineering
right triangle
rotation
scale model
sequential
taper
tension
texture
three-dimensional
tolerance
torsion
trade-off
transition fit
two-dimensional
vertext
volume