1.1 Engineering I

2. Systems & Optimization
    2.1 Systems
        2.1.1 Input
        2.1.2 Process
        2.1.3 Output
        2.1.4 Feedback
    2.2 Optimization
        2.2.1 Assess parts of a design
        2.2.2 Assess materials in a design
        2.2.3 Compromise
        2.2.4 Re-design
3. Technology/society interaction & Ethics
    3.1 Tech/Society interaction
        3.1.1 Technology is both a cause and a result of scientific activity
            3.1.1.1 Tools created by technology are used by scientists
            3.1.2.2 Scientists have needs that intern create tools
        3.1.2 Society influences and responds to engineering
        3.1.3 Society controls technological development
            3.1.3.1 Corporate America may be assisting disease stricken 3rd world counties for "face value"
            3.1.3.2 European markets are much more open to the introduction of new products
                3.1.3.2.1 based on the notion that Americans are much more likely to fear any type of risk in a new produce
                    3.1.3.2.1.1 more likely to bring about a lawsuit if something unplanned occurs
        3.1.4 Historical events have shaped and will continue to shape technologies
            3.1.4.1 Man on the moon
            3.1.4.2 Valdez oil spill

ADD TO THESE (TALLEST BUILDING, THINK OF THE ENGINEERING SHOW

        3.1.5 Scientific and technological issues are influenced by values
        3.1.6 Technology has positive and negative effects
            3.1.6.1 Internet Banking
            3.1.6.2 Nuclear power
            3.1.6.3 coal
            3.1.6.4 gasoline
            3.1.6.5 Electric cars (must make electricity—coal etc…car doesn't pollute environment but the process of making the electricity does)
        3.1.7 Some developments have no projected negative or positive effects
            3.1.7.1 Lasers
            3.1.7.2 Implants

- 3.2 Ethics
    - 3.2.1 Professional and legal responsibilities
        - 3.2.1.1 Hippocratic oath for doctors
        - 3.2.1.2 guidelines for professional conduct
        - 3.2.1.3 contractual obligations
        - 3.2.1.4 legally bound to live up to the performance standards specified
    - 3.2.2 Social responsibilities
        - 3.2.2.1 design and implement with a social conscience
        - 3.2.2.2 inform their publics about the risks
    - 3.2.3 Ethical dilemmas
        - 3.2.3.1 might place their own personal or professional values in conflict with those of employers or clients
        - 3.2.3.2 engineering decisions may involve making trade-offs
        - 3.2.3.3 when do engineers stop increasing safety or quality, and accept an increased risk to human life or the environment
    - 3.2.4 Whistle-blowing
        - 3.2.4.1 conflict between a company practice and their own social conscience
        - 3.2.4.2 notify someone outside the company
            - 3.2.4.1 newspaper
            - 3.2.4.2 television
            - 3.2.4.3 regulatory agency
        - 3.2.4.3 attempt to bring public pressure
        - 3.2.4.4 clear detrimental effects on both the company and the individual
        - 3.2.4.5 Roger Boisjoly
            - 3.2.4.5.1 Morton-Thiokol
            - 3.2.4.5.2 O-ring seals on the challenger rocket booster
    - 3.2.5 Resolving ethical dilemmas
        - 3.2.5.1 raise their concerns with the management
        - 3.2.5.2 creating channels for internal discussion of the issues
        - 3.2.5.3 respects the engineer's anonymity
            - 3.2.5.3.1 McDonnell Aircraft
            - 3.2.5.3.2 Raytheon Corporation
    - 3.2.6 Code of Ethics
        - 3.2.6.1 The fundamental principal
            - 3.2.6.1.1 Engineers uphold and advance the integrity, honor and dignity of the engineering profession by:
                - 3.2.6.1.1.1 using their knowledge and skill for the enhancement of human welfare
                - 3.2.6.1.1.2 being honest and impartial, and serving with fidelity the public, their employees, and clients
                - 3.2.6.1.1.3 striving to increase the competence and prestige of the engineering profession

3.2.6.1.1.4 Supporting the professional and technical societies of their disciplines

3.2.6.2 The fundamental Cannons

3.2.6.2.1 Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties.

3.2.6.2.2 Engineers shall perform services only in the areas of their competence.

3.2.6.2.3 Engineers shall issue public statements only in an objective and truthful manner.

3.2.6.2.4 Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.

3.2.6.2.5 Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.

3.2.6.2.6 Engineers shall associate only with reputable persons or organizations.

3.2.6.2.7 Engineers shall continue their professional development throughout their careers and shall provide opportunities for the professional development of those engineers under their supervision.

3.2.7 National Society of Professional Engineers (NSPE) Scenarios

3.2.7.1 Protecting public welfare

3.2.7.2 Falsifying Data

3.2.7.3 Conflict of Interest

3.2.7.4 Gifts to Foreign Officials

4. Concurrent engineering and teamwork

4.1 Definition

4.1.1 Synchronization or synergism of team members, groups of people or company departments to ensure that every person involved knows and understands the task at hand, the parameters that have to be met and the set of skills that will be employed to solve the problem.

4.1.2 Integrated Product Development (IPD) is a philosophy that systematically employs a teaming of functional disciplines to integrate and concurrently apply all necessary processes to produce an effective and efficient product that satisfies the customer’s needs

4.2 Initiated before brainstorming

4.2.1 Should be, but not limited to this timeframe

4.3 Multidisciplinary teams

4.4 Communication

4.4.1 Development

- 4.4.2 Manufacturing
- 4.4.3 Marketing
- 4.4.4 Distribution
- 4.5 Techniques, procedures, goals
- 4.6 Compromise
- 4.7 Agreement
- 4.8 Implementation

5. Design (Designers Notebook)
    - 5.1 generate product, processes and systems based on the recognition of a need
        - 5.1.1 Functionality
            - 5.1.1.1product or solution has to fulfill its intended purpose
                - 5.1.1.1.1 screwdrivers aren't designed to be used as a hammer
                - 5.1.1.1.2 tables aren't designed for people to stand on
        - 5.1.2 Quality
            - 5.1.2.1 product or solution must be designed to meet certain minimum standards
            - 5.1.2.2 in relationship to the conditions of the item's intended use
                - 5.1.2.2.1 quality is defined according to the proper or improper use of the item
                - 5.1.2.2.2 quality has to be evaluated in the context
                    - 5.1.2.2.2.1 wearing dress shoes to play basketball
                    - 5.1.2.2.2.2 wearing tennis shoes for everyday use
        - 5.1.3 Safety
            - 5.1.3.1 comply with codes and regulations
            - 5.1.3.2 provide safe use and operation by the user
                - 5.1.3.2.1 Air bags
                    - 5.1.3.2.1.1 Early design intended to save lives
                    - 5.1.3.2.1.1 Force of impact injured and sometimes killed users
                - 5.1.3.2.2 Child car seats
                    - 5.1.3.2.2.1 Often installed incorrectly by user
                    - 5.1.3.2.2.2 Design sometimes failed, injuring child
        - 5.1.4 Ergonomics (human factors engineering)
            - 5.1.4.1 percentiles
                - 5.1.4.1.1 50 % = average of all people in a culture
                - 5.1.4.1.2 90 % would be toward largest of people
                - 5.1.4.1.3 10 % would be towards smallest of people
            - 5.1.4.2 Culture dictates physical characteristics
                - 5.1.4.2.1 American
                - 5.1.4.2.2 Chinese
                - 5.1.4.2.3 African tribal
            - 5.1.4.3 User can operate with ease and maximum efficiency
                - 5.1.4.3.1 Chair design (cardboard chair)
                    - 5.1.4.3.1.1 For long term use

5.1.4.3.1.1.1 Recliners in home
5.1.4.3.1.1.2 Desk chairs at work
5.1.4.3.1.2 For short term use
5.1.4.3.1.2.1 Fast food restaurants
5.1.4.3.1.2.2 classrooms
5.1.4.3.2 Brake and gas pedals in vehicles
5.1.4.3.2.1 American females need pedals closer in most vehicles
5.1.4.3.2.2 move seat up, then too close to air bag
5.1.5 Appearance/Aesthetics
5.1.5.1 The appeal of a product is based on:
5.1.5.1.1 Materials
5.1.5.1.2 Processes
5.1.5.1.3 Finish
5.1.5.1.4 Color
5.1.5.1.5 Shape
5.1.5.2 If a consumer doesn't like what they see, they are less likely to buy it
5.1.5.2.1 First Toyota cars
5.1.5.2.2 Pre-worn clothing (i.e. ripped hats, jeans w/holes currently this IS an appeal to students)
5.1.6 Environmental considerations
5.1.6.1 product must be designed so that it does not adversely affect the environment
5.1.6.1.1 wind tunnels
5.1.6.1.2 decrease of vegetation in a area, decreasing oxygen generation and consumption of CO_2
5.1.7 Economics
5.1.7.1 produced at least cost without sacrificing safety
5.1.7.1.1 costs down
5.1.7.1.2 profits up
5.1.7.2 Sometimes cuts are made to keep profits up
5.1.7.2.1 Cuts sometimes lead to unsafe products
5.1.7.2.1.1 cuts in production
5.1.7.2.1.2 cuts in materials
5.1.7.2.1.3 cuts in safety systems
5.1.7.2.2 public is not concerned until something drastic happens
5.1.7.3 (e.g.) Sam Poong department store in Japan
5.1.7.3.1 collapsed, killing 1,500 people
5.1.7.3.2 management left after cracks appeared in walls
5.1.7.3.2.1 didn't tell employees or customers
5.1.7.3.3 people still shopping, employees still working
5.1.7.3.4 building collapsed because of poor building codes

5.1.7.3.4.1 too much water in the concrete mix to lessen the costs
5.1.7.3.4.2 created a very weak concrete structure

6. Modeling
- 6.1 Descriptive modeling
  - 6.1.1 Diagrams
    - 6.1.1.1 Cycle
      - 6.1.1.1.1 A diagram that is used to show a process that has a continuous cycle
    - 6.1.1.2 Target
      - 6.1.1.2.1 A diagram that is used to show steps toward a goal
    - 6.1.1.3 Radial
      - 6.1.1.3.1 A diagram that is used to show relationships of elements to a core element
    - 6.1.1.4 Venn
      - 6.1.1.4.1 A diagram that is used to show areas of overlap between and among elements
    - 6.1.1.5 Pyramid
      - 6.1.1.5.1 A diagram that is used to show foundation-based relationships
  - 6.1.2 Used to
    - 6.1.2.1 illustrate various conceptual material
    - 6.1.2.2 to enliven documents
  - 6.1.3 Graphs
    - 6.1.3.1 visually appealing easy for users to see
      - 6.1.3.1.1 comparisons
      - 6.1.3.1.2 patterns
      - 6.1.3.1.3 trends in data
  - 6.1.4 Flow charts
    - 6.1.4.1 document procedures
    - 6.1.4.2 analyze processes
    - 6.1.4.3 indicate work or information flow
    - 6.1.4.4 track cost and efficiency
  - 6.1.5 Block diagrams
    - 6.1.5.1 provides shapes to
    - 6.1.5.2 brainstorm
    - 6.1.5.3 plan
    - 6.1.5.4 communicate
  - 6.1.6 Verbal modeling
    - 6.1.6.1 description with words
  - 6.1.7 Mathematical modeling
    - 6.1.7.1 formulas to show data
  - 6.1.8 Scale models

6.1.8.1 A small object that represents in detail another, often larger object
6.1.8.2 A preliminary work or construction that serves as a plan from which a final product is to be made: *a clay model ready for casting*
6.1.8.3 Such a work or construction used in testing or perfecting a final product: *a test model of a solar-powered vehicle*

6.2 Functional modeling
6.2.1 Computer simulations
6.2.1.1 3D solid modeling
6.2.1.2 3D Animation
6.2.1.3 Finite Element Analysis
6.2.2 Physical models of real systems with moving parts

7. Problem Solving
7.1 Recognition of need
7.1.1 Direct response to specific needs and wants of society
7.2 Definition of the problem
7.2.1 Specifications clearly stated
7.3 Analysis of the problem
7.3.1 Brainstorming to formulate possible solutions
7.4 Selection of a solution
7.4.1 Chose optimal solution with the aid of a modeling system
7.5 Implementation or realization
7.5.1 Components required for the construction
7.5.2 Complete the construction of a prototype
7.6 Evaluations and testing
7.6.1 Analysis of the prototype
7.6.2 Are the specifications met?
7.7 Re-design
7.7.1 Modifications to the prototype based on the evaluation and testing phase

Resources:
www.howstuffworks.com
www.ask.com
http://www.mne.umassd.edu/wme/wme.html
http://www.uwm.edu/CEAS/
http://pltw.engr.sc.edu/
http://www.pltw.org/aindex.htm