TIDEE

Transferable Integrated Design Engineering Education

UNIT 1: Getting Started

The Making of an Engineer

What is an Engineer?

- Definition of an engineer by the Society of Woman Engineers
- Competencies during the First Two Years of Engineering
- Attributes of an Engineering Graduate
- Profile of a Top Quality Engineer

Journals

- Guidelines for Journals
- Evaluation Criteria for Journals

Assessing Learning Preferences

- Herman Four-Quadrant Learning Preference

Unit 1: Getting Started

Session 1: The Making of an Engineer

Announcements & Introductions (10 minutes)

What is an Engineer? (25 minutes)

What are the common elements between the engineering disciplines found on the handout from SWE's *Engineer*? What makes them different?

- Competencies during the First Two Years of Engineering
- Attributes of an Engineering Graduate
- Profile of a Top Quality Engineer

Journaling (15 minutes)

Initial Rules for Journals
Evaluation Criteria for Journals

A Taste of the Quarter: A Collaborative Activity (25 minutes)

Quickly form a group with three members. When the groups are formed, find two objects that are in your possession that could represent you! One person begins the process by describing to the other group members how these objects describe you. Other members must then combine this information into a creative cartoon sketch of you. Share the drawings and describe their meaning. Repeat the process until everyone has participated.

Gathering Information Needed to Select Members of First Design Team (10 minutes)

Hermann four-quadrant learning preference
Personal information
Times available to meet outside of class

What is an Engineer?

Document from Society of Women Engineers (waiting approval for reprinting)

Competencies Required During the First Two Years of Engineering Curricula

Outlined below are competencies that you should strive to develop during your initial years of engineering education. These skills will serve you well as you advance toward your degree completion and then on to work as a professional engineer.

TEAMWORK:
Participate Effectively in Groups or Teams

- Individuals understand their own and other member's styles of thinking and how they affect teamwork
- Individuals understand the different roles included in effective teamwork and responsibilities of each role
- Individuals use effective group communication skills: listening, speaking, visual communication
- Individuals cooperate to support effective teamwork

INFORMATION GATHERING:
Gather Information, Using Various Sources and Techniques, Including Analysis

- Individuals use important visual and oral techniques (questioning, observing) for information gathering
- Individuals use library resources effectively in accessing relevant information

PROBLEM DEFINITION:
Define Problem, Including Specific Goal Statement, Criteria and Constraints

- Individuals understand the open-ended nature of problems
- Individuals develop specific goal statements after gathering information about a problem (need)
- Individuals recognize the importance of problem definition for development of an appropriate design
- Individuals develop problem definitions with specific criteria and constraints

IDEA GENERATION:
Utilize Effective Techniques for Idea Generation

- Teams and individuals identify and utilize environments that support idea generation
- Teams brainstorm effectively
- Individuals apply effective techniques in their own idea generation
- Teams use techniques that synthesize ideas to increase overall idea generation

EVALUATION AND DECISION MAKING:

Utilize Critical Evaluation and Decision Making Skills and Techniques, Including Testing

- Teams follow an iterative approach that employs evaluation repeatedly in their design process
- Teams and individuals apply simple matrix techniques for evaluating proposed solutions

IMPLEMENTATION:

Implement the Design to a State of Usefulness to Prospective Clientele

- Teams manage time and other resources as required to complete their project
- Team members follow instructions provided by others in implementation

COMMUNICATION:

Communicate at All Stages of Development and Implementation of Design Solutions

- Individuals practice effective listening skills for receiving information accurately
- Individuals exhibit appropriate nonverbal mannerisms (e.g., eye contact) in interpersonal communication
- Individuals give and receive constructive criticism and suggestions
- Individuals record group activities and outcomes, ideas, date, etc. in personal design journals
- Individuals produce technical papers and memos in acceptable style and format
- Teams present design information in group oral presentations
- Individuals communicate geometric relationships using drawings and sketches

Desired Attributes of an Engineering Graduate

Engineering requires a holistic view of the world at large. Your success as an engineer is not merely predicated upon an understanding of mathematics and science. Rather, it is your ability to use your knowledge in context of the problem set before you. Consider the items listed below as you pursue your degree. Employers look for graduates that possess the following attributes:

- A good understanding of engineering science fundamentals.
  - Mathematics (including statistics)
  - Physical and life sciences
  - Information technology (far more than "computer literacy")

- A good understanding of design and manufacturing processes, (i.e., understands engineering).

- Possesses a multi-disciplinary, *systems* perspective.

- A basic understanding of the *context* in which engineering is practiced.
  - Economics
  - History
  - The environment
  - Customer and societal needs

- Good Communication skills.
  - Written
  - Verbal
  - Graphic
  - Listening

- High ethical standards.

- An ability to think both critically and creatively – independently and cooperatively.

- Flexibility – ability and the self-confidence to adapt to rapid/major change.

- Curiosity and a desire to learn – for life.

- A profound understanding of and commitment to teamwork.

Profile of a Top Quality Engineer

Engineers at the top of their profession often exhibit similar characteristics. A recent survey of engineers catalogued several traits commonly found in engineers performing at a high-level within industry.

Results-Driven—Accepts responsibility; maintains focus and acts with urgency to complete important tasks amidst multiple demands; takes necessary initiative and appropriate risks to overcome obstacles and achieve objectives
Technically Competence—Properly applies knowledge, methods, and state-of-the-art tools of engineering to analyze and solve engineering problems; capable in fundamentals of mathematics, statistics, physical and life sciences, engineering sciences, experimental methods, engineering economics, and information technology
Engineering Judgment—Thinks critically to recognize and understand crucial questions, draws evaluation criteria from diverse sources, evaluates multiple alternatives against established criteria and associated risks, makes vital judgments, and checks viability of decisions
Creativity and Innovation—Thinks creatively (independently and cooperatively) and searches broadly to identify and formulate innovative approaches; models and supports conduct that enhances creativity
Client-Oriented Quality Improvement—Establishes successful relationships with internal and external clients to understand and anticipate their needs (definitions of quality); achieves or exceeds agreed-upon quality standards; measures achievement, identifies root causes of problems, and revises processes for continuous improvement
Business Orientation—Understands the factors that drive business success in today's marketplace; adapts efforts to appropriately support the changing business needs of the organization for which work is done
Responsible Engineering—Design, produce, and employ engineering products and processes within the context of global, societal, environmental, and organizational constraints; use technologies constructively to protect society and to mitigate undesirable impacts
Ethics and Professionalism—Exhibits integrity and ethical behavior in engineering practice and relationships; participates in discipline-appropriate professional societies to establish standards and ensure that engineers comply with professional codes and standards
Team Performance—Respects and works effectively with diverse people; builds and maintains productive working relationships; resolves conflicts productively; performs as a trustworthy team player; encourages, assists, and rewards individual and team successes; capitalizes on diverse expertise and perspectives
Professional Development—Anticipates change, remains flexible, and applies ongoing self-assessment, planning, and effort to continue to grow professionally and deal constructively with changes in the organization and society; helps others grow professionally and respond to change
Communication—Listens and observes attentively and effectively to assess audience information needs; organizes and expresses thoughts clearly and concisely, both in speaking and writing, with necessary supporting materials to achieve desired understanding and impact; keeps stakeholders informed about matters that affect their work; protects confidentiality

Journals

Engineers are often involved in documenting project development and processes. As such, a journal will be an important tool for your academic and professional development. A journal or logbook allows you to reflect back upon recorded data and information when needed. Learning to document your actions will serve you well in your future career. This class begins the habit of journaling.

Initial Rules for Team Journals

- Use a spiral notebook. Number the pages. (Loose-leaf is not acceptable.)
- Save first 8 to 10 pages to create a Table of Contents
- Rotate the responsibility to make entries among team members.
- Record every team meeting: date, time, location, attendees, what was discussed, ideas and who had them, decisions made, and assignments.
- Also record work completed outside of meetings.
- Record in writing, but also paste in sketches, data sheets, evaluation forms, etc.
- Record the team part of homework assignments.
- Record the work of your team so a reviewer can understand it.

Evaluation Criteria for Journals

Name _____

Journal Grade _____HW Grade_____

Evaluate each item below. Discuss how the grade was determined. Provide suggestions on how to improve the journal.

Mechanics:
Organization/Who/What/How/When/Table of Contents/Flow of information/Ease of extracting information/Highlighting important ideas.

Poor, Fair, Okay, Good, Very Good, Excellent

Record Activities:
Class and team meetings/Observations/Sketches/Information/Discussions

Poor, Fair, Okay, Good, Very Good, Excellent

Critical Analysis:
Synthesize information/Evaluate/Categorize/Prioritize/Conceive ideas/Develop concepts

Poor, Fair, Okay, Good, Very Good, Excellent

Process Development and Improvement:
Establish schedules/describe progress/Resolve conflicts & communication issues/Set goals/Record insights, evaluations, feedback & reflectors' reports

Poor, Fair, Okay, Good, Very Good, Excellent

Homework Assignments:
Readings/Note taking/Quality/Completeness

Poor, Fair, Okay, Good, Very Good, Excellent

General Comments:

Assessing Learning Preferences

Herrmann Four-Quadrant Learning Preference*

Mental models provide a metaphorical tool for examining how you and your future teammates learn. One of the more well known models is the Herrmann brain dominance model. Ned Herman, the model's creator, suggested that the each individual has four modes of thinking that are denoted by quadrants A through D.

A: Analyzer
B: Administrator
C: Collaborator
D: Synthesizer

The quadrants are briefly outlined on the next few pages. According to Hermann "each person is a unique mix of these modes of thinking preferences and has one or more strong dominances." Although you may have a natural tendency in one area, effort can be made to successfully develop "weak" areas.

Preferred learning activities: If you are an A-quadrant thinker, you prefer to learn and act in this way:

__ Collecting data and information.
__ Organizing information in a framework, not to the last detail.
__ Listening to informational lectures.
__ Reading textbooks (most textbooks are written for quadrant A thinkers.
__ Studying example problems and solutions.
__ Thinking through ideas.
__ Doing library searches.
__ Doing research using the scientific method.
__ Making a hypothesis, then testing to see if it is true.
__ Judging ideas based on facts, criteria and logical reasoning.
__ Doing technical case studies.
__ Doing financial case studies.
__ Dealing with hardware and things, rather than people.
__ Dealing with reality and the present, rather than with future possibilities.
__ Traveling to other cultures to study technological artifacts.

_____ Total check marks

*Adapted from Creative Problem Solving by Lumsdaine & Lunmsdaine

Preferred learning activities: If you are a B-quadrant thinker, you prefer to learn and act in this way:

__ Following directions instead of trying something in a different way
__ Doing repetitive, detailed homework problems.
__ Testing theories and procedures to see what is wrong with them.
__ Doing lab work, step by step.
__ Writing a sequential report on the results of experiments.
__ Using programmed learning and tutoring.
__ Finding practical uses for knowledge learned—theory is not enough.
__ Planning projects; doing schedules, then executing according to plan.
__ Listening to detailed lectures.
__ Taking detailed notes.
__ Making time management schedules—the schedule is important, not people.
__ Making a detailed budget.
__ Practicing new skills through frequent repetition.
__ Taking a field trip to learn about organizations and procedures.
__ Writing a “how-to” manual about a project.

____Total check marks.

Preferred learning activities: If you are a C-quadrant thinker, you prefer to learn and act in this way:

__ Listening to and sharing ideas.
__ Motivating yourself by asking “why”—looking for personal meaning.
__ Experiencing sensory input—moving, feeling, touching, smelling, tasting.
__ Using a group-study opportunities and group discussions.
__ Keeping a journal to record feelings and spiritual values, not details.
__ Doing dramatics—the physical acting out is important, not imagination.
__ Taking people oriented field trips.
__ Traveling to other cultures to meet people; hosting a foreign student.
__ Studying with classical background music; making up rap songs.
__ Using people-oriented case studies.
__ Respecting others’ rights and view; people are important, not things.
__ Learning by teaching others.
__ Learning by touching, feeling, and using a tool object, or machinery.
__ Reading the preface of a book to get clues on the author’s purpose.
__ Preferring video to audio to make use of body language clues.

_____ Total check marks

Preferred learning activities: If you are an D-quadrant thinker, you prefer to learn and act in this way:

__ Looking for the big picture and context, not the details, of a new topic.
__ Taking the initiative—getting actively involved.
__ Doing simulations—asking what-if questions.
__ Making use of visual aids in presentations or lectures.
__ Doing problems with many possible answers.
__ Appreciating the beauty in the problem (and in the solution).
__ Leading a brainstorming session—wild ideas, not the team, are important.
__ Experimenting; playing with ideas.
__ Exploring hidden possibilities.
__ Thinking about trends.
__ Thinking about the future.
__ Relying on intuition, not facts or logic.
__ Synthesizing ideas and information to come up with something new.
__ Using future-oriented case discussions.
__ Trying a different way of doing something just for the fun of it.