

Department of Civil Engineering Senior Design I – CE4188

Instructor Contact Information and Biography

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For class matters use Blackboard e-mail under the class communication tools. I will repond to your emails within 24 business hours.

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About me:

I grew up in Guayanilla (http://en.wikipedia.org/wiki/Guayanilla,_Puerto_Rico), a municipality of Puerto Rico, located on the southern coast of the island, bordering the Caribbean Sea, south of Adjuntas, east of Yauco; and west of Peñuelas and about 12 miles (20 km) west of Ponce, the 2nd largest city of Puerto Rico. (http://en.wikipedia.org/wiki/Ponce,_Puerto_Rico) (population <200,000).



I have a Bachelor's degree in Civil Engineering from the University of Puerto Rico at Mayaguez (UPRM), a Master's degree in Environmental Systems Engineering from Clemson University, and a Ph.D. in Civil Engineering, Specialized in Environmental

Engineering, from New Mexico State University. In Puerto Rico, I was a professor in Civil Engineering at UPRM and worked in research (EPA, DOD, NSF) dealing with removal of contaminants from water using natural adsorbents, remote telemetry systems for monitoring of a small community drinking water treatment plant, physical modeling of transport of explosive related chemicals in sub-surface environments, and odor problems of combined sewer-overflows. I worked as consultant to the Comptroller of Puerto Rico as an auditor of the 10 largest water and wastewater treatment plants in Puerto Rico. I was part of the Puerto Rico Environmental Quality Board (PREQB) and Director of the Water Quality Area in the PREQB. I am currently a Clinical Professor in the Department of Civil Engineering, I am an appointed member of the El Paso Water Public Service Board (PSB), and I am on my third term as a member of the Environmental Protection Agency National Advisory Committee (NAC). The NAC advises the administrator of the EPA on environmental policy issues related to the implementation of the North American Agreement on Environmental Cooperation. I was also a member of The Good Neighbor Environmental Board (GNEB) that advises the President and Congress of the United States on good neighbor practices along the U.S. border with Mexico. Since I have been at UTEP. I have taught courses in Environmental Engineering, Engineering Economy, Engineering Statics, Water and Wastewater Engineering, Capstone Senior Design Courses (I and II), Thermo-fluids, and Experimental Design. There is not enough space in this syllabus to explain why I left "paradise" for El Paso, but my family ended up here in 2006. I can say I really have come to love UTEP and our students. I have found hard-working students that truly want to build a better future for themselves and their families. You can learn more about my teaching philosophy at <http://engineering.utep.edu/announcement073117a.htm>

A few things I want to share about this class

Introduction

This course is the culminating experience of your Civil Engineering College Education. This is where you will combine and put into practice your knowledge of structures, environmental, construction management, transportation, and geotechnical fields.

This capstone course meets ABET requirements while satisfying the needs of government, professional organizations, engineering companies, hiring companies, and universities seeking strong independent problem-solvers.

The Civil Engineering Department seeks feedback from our stakeholders, industry advisors, and employers to continuously improve our curriculum. Collectively, they all agree that we need to provide you, our students, with experience working in teams, professional communications, project, and time management skills with the purpose of solving Civil Engineering Design Problems.

During the first few weeks of the semester, there will be significant in-class interactive group activities. These are designed to help acquaint student teams with the project and with each other. Students are expected to actively learn and understand design concepts and methods. There will be little or no lecture, you will be working in teams throughout the semester.

Through the course, you will learn professional skills associated with effective technical oral and written communications, ethics, project management, and teamwork. We will use formative and summative assessment methods that can provide the necessary feedback for you to improve your skills.

Regular team meetings with and without your mentor, formal presentations, written reports, and site visits with clients and faculty will set the stage for you to develop your project ideas. Client approval will be a critical step to move forward in your design. Documentation is a necessary activity during the whole design process. You will be required to document your process and your progress using log books, blogs, discussion boards, or wikis.

Objectives of the Class (from TIDEE)

The emphasis will be on developing your primary capabilities in the three categories of **design process, teamwork, and communication**. They include the following objectives.

Objective 1: Design Process

When assigned a significant design project, you will be able to manage, assess, and improve your design efforts to conceive, create, evaluate, and deliver a design to satisfy needs of a diverse set of clients.

Objective 2: Teamwork

When your team is given a collective responsibility, your team will be able to organize and develop a cohesive, energized team; plan, execute, critique, and improve team processes; and produce required deliverables within allotted resources.

Objective 3: Communication

When you work in design teams, you will be able to establish and implement communication processes to effectively record, critique, and exchange information inside and outside the team for quality performance and impact required of others.

Areas in particular that need significant developmental work are how to write problem definitions, develop managerial and planning skills, and how to effectively reach team decision or consensus.

Processes for making team decisions will be introduced that helps the team focus on issues rather than having someone with a strong personality or style of management control the decision making process.

Because this is a creative process, good oral and written communication is absolutely needed for the team to function effectively and produce imaginative solutions

What makes this course challenging?

There are several reasons why the Senior Design courses pose the biggest challenge of your college career:

1. You will have to venture into new territory that is unfamiliar, unknown, and at times uncomfortable for you, such as immersion into city codes and regulations. There is no recipe, prescription, or right or wrong design, this will be real client-based **open-ended design**. Understandably, attacking real-world problems with only three years of college education and minimal consulting experience can be overwhelming for some of you. You will need to dig into your creativity and use the positive synergistic energy within your team.
2. You will need to work in teams. This project is impossible to be completed by one or two individuals, cooperation and willingness to work hard from every member of the group is vital for the success of the project.
3. You will need to plan dates of meetings and milestones. Time management is of the essence if you want to finish the project and still be sane the day of the final presentations.

What I believe about this class

- 1) This class will be a challenge for most of you, but in the end it will be the most gratifying class you will have taken.
- 2) I am responsible for designing activities that challenge you and increase your understanding of the tasks you need to perform NOT of the technical material you should know.
- 3) Although I do my best to encourage and facilitate the successful completion of your project, no one else but you is ultimately responsible for making sure you complete it.
- 4) I will provide you feedback on how you are performing in the class through Blackboard, but likewise, I expect you to provide me with feedback on the effectiveness of the assignments, quizzes, and exams.

Capstone Student Role

I have worked jointly with potential clients, including the City of El Paso, in the selection of projects that incorporate the areas of Civil Engineering that are offered at UTEP. It is up to you to make the project a success by committing to the following guidelines (Modified from EEIC):

1. As a team, create a team charter. Each individual team member agrees to a role and responsibility and a shared sense of purpose in pursuing a successful final project design
2. Establish a team leader and customer liaison
3. Perform professionally, especially when interfacing with the customer
4. Follow the design process with a focus on understanding the client's needs and meeting established benchmarks, including project deliverables
5. Create and adhere to a project schedule
6. Be a good team member and encourage others to be the same
7. Develop an understanding when to seek advice and assistance from project mentors and advisors, especially in the area of the resources to understand and solve the design problem
8. Hold effective team meetings
9. Keep a well-documented project notebook
10. Take extreme care in documenting and keeping private all potential intellectual property

11. Invest an average of a minimum of 10 hours/week on this project
12. Use time management skills to complete assigned tasks on time and with high quality
13. Attend all team meetings and company visits and be flexible with your schedule to allow for mutually convenient meeting times
14. Hold yourself and others accountable for your respective responsibilities
15. Participate in all formative assessment activities
16. Provide constructive feedback to the course instructor to improve the program
17. Participate in the final design presentation and possible Capstone Design Showcase event.

Capstone Project Mentor Role (modified from EEIC and RPI)

Your project advisor (mentor) will serve the role of team coach. The primary responsibility is to provide overall guidance, direction, and support for the team. Mentors provide overall technical guidance, advise on professional development opportunities, and help make sure the project team has not overlooked important steps in the design process. **MENTORS MUST NOT BE PAID FOR THEIR SERVICES.**

Advisors may be faculty members with experience working with teams or professional engineers with technical familiarity with the scope and work required by the design projects. Some guidelines for mentors which generally lead to a successful team project are:

1. Attend the kick-off student team meeting
 - a. Assist in keeping team realistic expectations and on track with the project scope.
 - b. Lead the discussion to define realistic project goals
 - c. Establish logistics for on-going meetings, progress reports, and presentations
2. Advise the student team
 - a. Help team assign roles
 - b. Coach the team in creating time line and define necessary tasks
 - c. Attend and advise students in status-review meetings
 - d. Attend final design presentation
 - e. At progress meetings, review past performance, future tasks, and hurdles. Assist when necessary hurdles arise that may detract from reaching the goal of completing a successful project design.
 - f. Coach the students in professional communications
3. Hold the student team accountable for their responsibilities
 - a. Review notes and/or unnecessary delays in meeting project deadlines
 - b. Review and approve technical drawings and specifications
4. Grade the team's overall performance and value individual contribution
 - a. Overall progress in understanding the design process and applying their knowledge and skills to the project.
 - b. Personal commitment to achieve results and contribute to team effort
 - c. Written reports
 - d. Quality of the final design
5. Help improve team effectiveness
 - a. Promote consistent communication guidelines (written and oral)

- b. Foster team building, leadership, and interpersonal skills within the team

It is important for mentors to understand that this is a student project and that they act as coaches. It is important NOT to become the lead designer but to encourage students to seek their own resources of knowledge and create their own solutions.

Documentation

An ongoing record (Project Notebook) of the project will be maintained in either hard copy or electronic form. Documentation will include all submitted assignments, meeting minutes, decisions, results, technical documentation, trip visit, summary reports, etc.

Why a Project Notebook?

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 Projects Notebooks

- 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.

Assignments

Written documents should follow the format in the respective assignment description.

Oral Presentations

Typically, presentations are in PowerPoint or Prezi. Presentations on design project must be reviewed by the team's mentor(s).

Final Written Report

Final written report is a formal design document and it should not have more than 20 pages, double spaced, 12-point font. It should include the following parts:

1. Executive summary
2. Introduction
3. Background (Problem definition/Specification)
4. Concept Design
5. Design considerations
6. Conclusion
7. Bibliography

All figures and drawings must be contained within the 20-page limit. Appendices are for showing results of research or supporting technical documentation.

Course Resources

Textbook

The textbooks used in previous courses are often useful as references. Students are required to research and collect information relevant to the assigned project.

There is not a required textbook but you must purchase a subscription to **PitchVantage**. I will provide you details on the subscription to this service soon.

References:

You will need to apply your technical knowledge and learn to find and understand codes and regulations that are applicable to your project. There some of the documents you will need to revise:

- IBC (International Building Codes) (http://en.wikipedia.org/wiki/International_Building_Code)
 - There is a 2012 IBC version available for purchase at <http://www.iccsafe.org/Store/Pages/Product.aspx?id=3000X12#longdesc>
 - You will need these as your guide for your conceptual design (floor and site plans)
- City of El Paso Smart Code (http://www.planelpaso.org/wp-content/reports/SmartCode_presentation-to-Council_20July.pdf)
 - The Smart Code as of today, is optional, but for new City projects is a requirement. For the designs in this class Smart Code will be required. The Smart Code supersedes the IBC regarding site planning.
 - Smart code is available free of cost at : <http://www.ci.el-paso.tx.us/documents/SmartCode%20Adopted%2029%20July%202008.pdf>
- Other City codes
- LEED (Leadership in Energy and Environmental Design) documentation developed by the US Green Building Council (USGBC) (<http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1988>)
- Other applicable codes in steel and concrete design, transportation, and environmental issues.

Software that you can use

All faculty, staff, and students of UTEP are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator.

1. You can use <http://doodle.com/> to facilitate the scheduling process
2. You **MUST USE STAAD** for the structural design. We have it available at CE
3. You can use free EPA models for hydrologic analysis (<http://www.epa.gov/athens/wwqtsc/html/swmm.html>) such as SWMM or Corps of Engineers (<http://www.hec.usace.army.mil/software/>) such as HEC-HMS. The important consideration is that whatever model you use, you understand how it works and why is applicable to your specific conditions.
4. You can use Primavera or Microsoft Project.
5. In addition to STADD, Bentley has lots of Civil Engineering Software - from buildings to bridges, transit to utilities, clean energy to clean water. The CE Alumni has paid enough licenses for all of the students enrolled in the Senior Design courses. As soon as I get access information from Dr. Carrasco, I will forward it to you.

Blackboard

Research papers and other materials will be posted on the Blackboard course site.

How do you earn your grade?

The assessments serve to give you valuable feedback about how well you are achieving the learning objectives. The assessments are “forward looking.”

Individual Grade Components

Individual or group homework or presentations: Homework must be submitted during the scheduled class period to receive full credit. Homework must be submitted in class on the due date to be considered on-time. **Peer teamwork** behavior evaluation: one or two semester online evaluations of each team mate (including yourself) will be conducted during the semester, because it is important in this class to let your team mates know how they are performing as a part of the team.

Exams: No exams will be given

Oral Presentations: On proposed design, ethical and professional issues and final design

Attendance: Design is not a spectator sport. Active in-class and out of class participation is required. You are expected to be on time to class, to meetings with your mentor and project team. You must always be prepared for short impromptu presentation of your work during the semester and this may affect your group grade.

Additionally, University policy dictates that all students attend all scheduled classes. Attendance can be checked randomly, and not necessarily in every class, by the instructor through sign-up sheets, exams, roll calling, randomly picked names for problem solving in class, Socrates, or other mechanisms. The instructor appreciates all efforts to attend the class. YOU AND ONLY YOU ARE RESPONSIBLE FOR SIGNING ATTENDANCE SHEETS, WHEN PASSED AROUND THE CLASS.

Evaluations, surveys and forms

- Team and individual evaluations; Project notebook and/or reports at different times of the semester

Major Deliverables

Schedule will be posted on BB. Presentation on architectural, technical, and regulatory considerations (compliance with IBC, smart code, and LEED)

Final Concept Design that includes plans and specifications.

Grading

Description	Content	Percent of Final Grade
Attendance	Attendance to all classes and scheduled seminars or presentations (10%) (Individual grade). If you don't have any absence, your get 5% If you have two: 4% If you have more than two but less than four (included): 3% If you have more than four absences, but less than six (included): 1% If you have more than six absences, you may get an F in the class.	5%
Peer Evaluation (Teammates)	Members of your group will evaluate you based on attendance to meetings, participation, and contribution to group design project (at midterm and final of semester)	15%
Written reports, Oral presentations, reports, class participation	In-class presentations on technical and ethical issues, ethics, progress reports, and project notebook (journal) (Grade per group)	10%
Final Written Report signed by mentors, and final presentation	Progress report at end of semester and strategic plan for following semester. <u>All work must be original and yours. Paying someone (anyone) to do all or any part of the work is grounds for a final grade of F in the course for the whole group (F for every member of the group).</u>	70% (35% for final report and 35% for final presentation)

Grade Distribution

The grade is determined by “project success”, which is defined as how well the project results meet the needs of the customer. At the same time, consideration is given to the process of achieving success such as meeting schedules, planning, and initiative (RPI). Your final grade will be calculated based on the points you have accumulated as follows:

Letter Grade	Grade	Performance Characteristic
A	≥ 89.5	Outstanding-must demonstrate initiative, self-motivation, and go beyond what is asked
B	≥ 79.5 but < 89.5	Above average-all assignments and tasks were done on time and done correctly
C	≥ 69.5 but < 79.5	Average-work done on time but shows lack of initiative
D	≥ 59.5 but < 69.5	Below average-work is late, only partially fulfills requirements and shows no initiative
F	< 59.5	Failing grade-work missing and does not fulfill requirements

Note that 89.44 is B, 79.44 is C, 69.44 is D, 59.44 is F. This is where your bonus points come to your rescue!

The instructor reserves the right to revise this grading plan. However, students will be informed of any changes.

Time Management

Deadlines for all assignments and tasks will be posted on BB. One of your tasks is to develop a Time Management Plan for yourself and your team. This means that you will:

- 1) Create a weekly calendar containing you class times, your work times, your family activities, your breakfast, lunch and dinner activities, your physical activities and exercise, time to go shopping, etc.
- 2) Create a semester calendar for including the months of August, September, October, November, and December, in which you enter your weekly activities and the quizzes and exams for each of your courses. Create your plan and stick to it!!

Class Policies

Purpose: These policies serve to help make the learning experience optimally effective and enjoyable for everyone.

Professional conduct

During this course, I expect you to deal with your peers and with me in a professional manner. Be courteous and honest and always communicate with each other in a way that shows respect and sensitivity to gender, cultural, religious, sexual, and other individual differences. I expect you to come to class on time and stay focused on the lecture and learning activities.

Additionally, students should represent themselves in a professional manner in forums that have public access (Facebook, twitter, and others). Information on these pages is often screened by potential employers, and un-professional material can have a negative impact on job or graduate school prospects.

Any form of sexual harassment or intimidation will NOT be tolerated. Policies are available on the UTEP web page. When a complaint is received, the situation will be investigated by the Office of Student Life and possible by the police, even if the harassment was done anonymously or possibly as a joke. Being found guilty of harassment is likely to be professionally damaging.

Cell Phones are OFF in Class

First, professionals turn off their phones in a meeting with other professionals in order to give full attention to the discussion. Second, a ringing phone disrupts because the sound of a phone attracts attention. Disruptions of the learning process are annoying. Your meeting time in class is valuable, chat and text with your friends outside of your team meeting. **Turn your cell phone off and put it in your backpack** .

Use of Laptops

I do not mind you using your laptop in class, except when it disrupts the learning process. I will not accept surfing the internet on topics not related to your class activities, or answering your email, instant messaging, chatting, video viewing, music playing, game playing, etc. This activity show a lack of respect for your classmates and myself, and also shows a disinterest in the course which is un-professional and un-acceptable. If you do, you will no longer be allowed to use your laptop in class. A few suggestions that will help the use of laptops in class:

1. Charge your laptop batteries fully before coming to class.
2. Set your laptop volume control to mute or off before coming to class.
3. Keep your laptop closed during presentations and other specific in-class activities.

Cheating, Plagiarism, Scholastic Dishonesty, and Student Discipline

Cheating is unethical and not acceptable. Plagiarism is using information or original wording in a paper without giving credit to the source of that information or wording; it is also not acceptable. Do not submit work under your name that you did not do yourself, ever. You may not submit work for this class that you did for another

class. If you cheated or plagiarized, you will be subject to disciplinary action as stated in the UTEP undergraduate catalog policy.

“Scholastic dishonesty (which includes the attempt of any student to present the work of another as his or her own, or any work which s(he) has not honestly performed, or attempting to pass any examination by improper means) is a serious offense and will subject the student to disciplinary action. The aiding and abetting of a student in any dishonesty is held to be an equally serious offense. All alleged acts of scholastic dishonesty should be reported to the Dean of Students for disposition. It is the Dean of Students’ responsibility to investigate each allegation, dismiss the allegation, or proceed with disciplinary action in a manner which provides the accused student his or her rights of due process.”

Refer to <http://www.utep.edu/dos/acadintg.htm> for further information.

You must cite, reference, or quote information obtained from other sources so you give credit where credit is due. If you do not know how to do that, ask. In addition, when an assignment specifies that you must perform a task individually, asking for your classmates’ help is scholastic dishonesty. Do NOT copy any material, regardless of where you obtained it, into your own work. Do NOT submit work under your name if you did not complete it entirely yourself; be honest and tell me you did it together. The consequences will be less severe when you are up front about it than when you try to hide it.

UTEP now has a site license for Turnitin.com, a plagiarism detection tool that you can also use to check your own work for this or other classes to prevent getting in trouble. I will report any instances of plagiarism and dishonesty to the Dean of Students Office and the grade for the assignment will be an “F” or “zero”.

If you want to test your understanding of plagiarism, take the self-assessment at <http://education.indiana.edu/~frick/plagiarism> or visit <http://www.turnitin.com>

Students with Any Type of Disability

UTEP seeks to provide reasonable accommodations for all qualified individuals with disabilities, including learning disabilities. This university will adhere to all applicable federal, state, and local laws, regulations and guidelines with respect to providing reasonable accommodations as required affording equal educational opportunity. It is the student's responsibility to register with Disabled Student Services Office in the East Union Bldg., Room 106 within the first two weeks of classes, and inform the faculty member to arrange for appropriate accommodations.

The Disabled Student Services Office can also be reached in the following ways:

Web: <http://www.utep.edu/dsso>

Phone: (915) 747-5148 voice or TTY

Fax: (915) 747-8712

E-Mail: dss@utep.edu

Tentative schedule of topics. Please not that you should start working on your project from Day 1

Week/date	Topics covered
1 Aug 27-31	Introduction, Personality tests to create balanced teams, discussion of potential project
2 Sept 3-7	Developing Teams
3 Sept 10-14	Mr. David Coronado, Director of International Bridges Department, City of El Paso
4 Sept 17-21	Team Building Exercises-strengths and weaknesses game
5 Sept 24-28	Team Logo What are the characteristics of a great group member?
6 Oct 1-5	Team Contract
7 Oct 8-12	Technical presentations and technical reports Homework: research international bridges
8 Oct 15-19	Group presentations on other international bridges along US/Mexico Border and other international crossings-what works? What does not work?
	1 st Draft of report due-October 19 th
9 Oct 22-26	Provide feedback on reports-groups make appointment during the week.
10 Oct 29-Nov 2	Finish Group presentations on other international bridges along US/Mexico Border and other international crossings-what works? What does not work?
11 Nov 5-9	2 nd draft of Report due – November 9 th Wrapping up reports. Final Q&A session and expectations Innovation and entrepreneurship in Civil Engineering?
12 Nov 12-16	Mock presentations
13 Nov 19-23	Thanksgiving-no class
14 Nov 26-30	Final presentations of the reports to the City of El Paso
15	December 7 th – Dead Day Final Senior I presentations – 8:30-11:50 am Must Attend Senior II final presentations at 10:30 am Business 319

NOTE: Unexpected events may necessitate changes in the course schedule, policies, and assignments. If feedback indicates that change may improve your learning experiences, such change will be made only upon mutual agreement between the instructors and the students.

Food for Thought: 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

<http://www.tidee.wsu.edu/resources/curriculum-materials/documents/f/unit1/Session1-TheMakingofanEngineer.pdf>