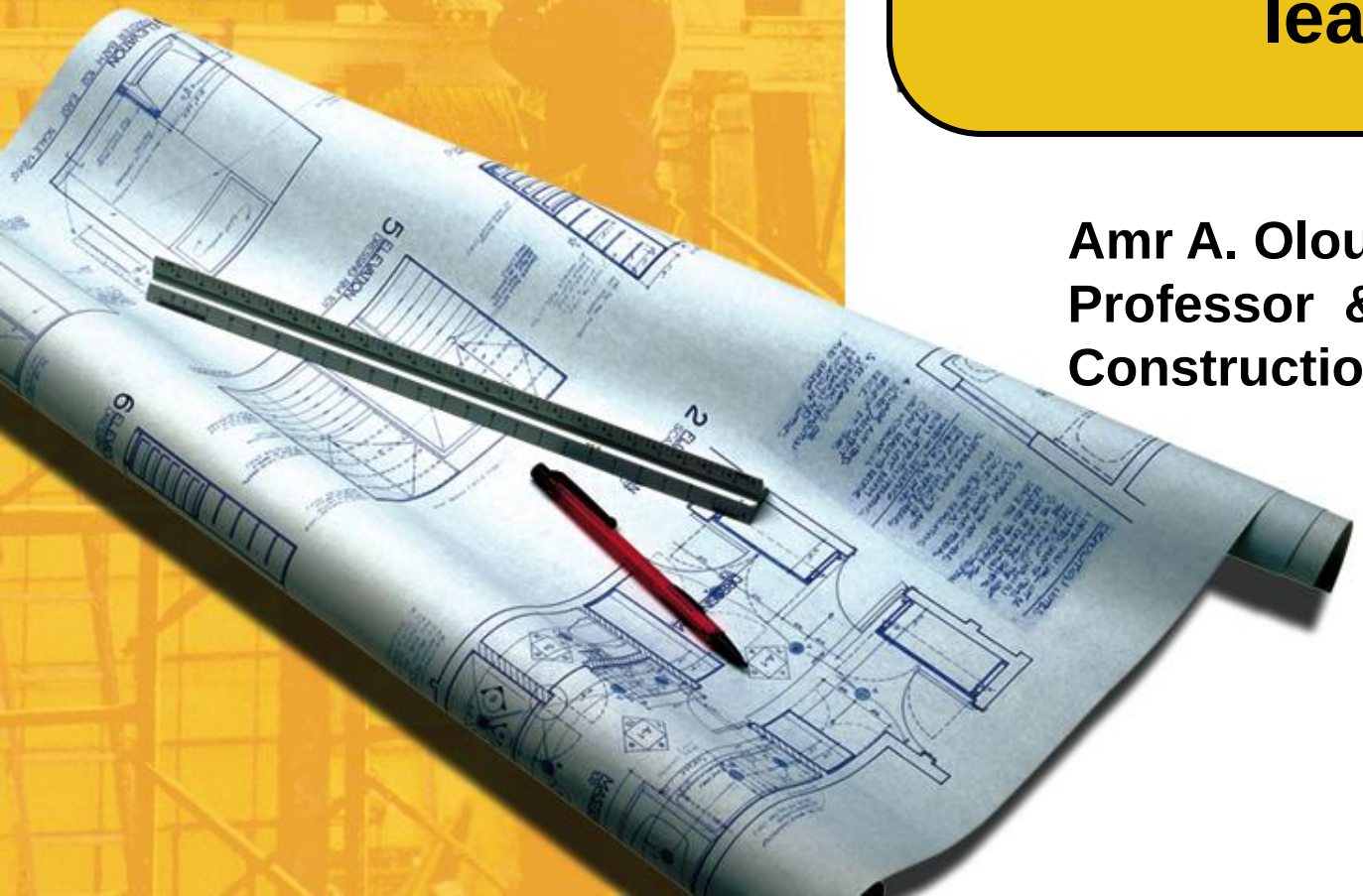
Educating Future Construction Engineers:

What do they need to learn?



Amr A. Oloufa, Ph.D., P.E.
Professor & Director of Construction Programs

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CONSTRUCTION ENGINEERING

- **Program History**
- **Why?**
- **Goals**
- **Curriculum**
- **The Future**

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THE FLORIDA CONSTRUCTION INDUSTRY

- **State-wide Construction industry for 2009 was $65 billion**
- **Average annual salary: $90,000 with 10 years experience**

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Our Goals

- **To develop highly educated construction professionals**
- **Develop the next generation of industry leaders**
- **Fill workforce void**
  - Construction cannot be outsourced
- **Industry access to research**

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History

- Existence primarily industry driven
- 128 credits – 4 years
- Started in 2000 as an option in Civil Eng.
- ABET-Accredited within CE in 2002
- About 120 students/30 graduates annually
- New Construction Engineering Major 2007
- Program Received Accreditation in 8/2009

Accredited Programs (ABET)

1. University of Central Florida
2. Iowa State University
3. University of Nebraska-Lincoln
4. New Mexico State University
5. North Carolina State University
6. North Dakota State University
7. Purdue University
8. Western Michigan University

WHY CONSTRUCTION ENGINEERING?

- Respond to industry needs.
- Provide an alternative technical career in Civil & Environmental Engineering.
- Provide an educational path to management careers.

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Accomplishments

- **Industry-sponsored endowment.**
- **ABC National Chapter.**
- **Strong industry liaisons.**
- **An excellent and dedicated pool of Adjuncts.**
- **Satisfied Students.**

Contributions to Department

- Student FTE.
- Popular technical electives.
- CCE 4003 (Engineering Economics, Multidisciplinary, Ethics, Project Management).

Engineering Education

Cost is either ignored or just “tolerated”.

No concept of Cash Flow

Little regard for Communications

Lip service to Teamwork

Preparation for Graduate School

Emphasis on “*Design*”

What is Design?

Construction Education - Orientation

Construction Engineering

Construction Management

Educational Challenges

Math & Science in Engineering?

Who is our client?

Who is our client?

Students

Parents

Industry

Technician

Scientist

Engineer

Contemporary Issues

- Engineering Knowledge Depth
- Innovation
- Integration
- Systems Thinking

Contemporary Issues

- **Knowledge *(I can define it)***
- **Comprehension *(I understand it)***
- **Application *(I have used it)***
- **Analysis *(I know how each part works)***
- **Synthesis *(I can adapt it to other uses)***
- **Evaluation *(I know when to use it)***

ABET – Engineering Programs

Criterion 3. Program Outcomes

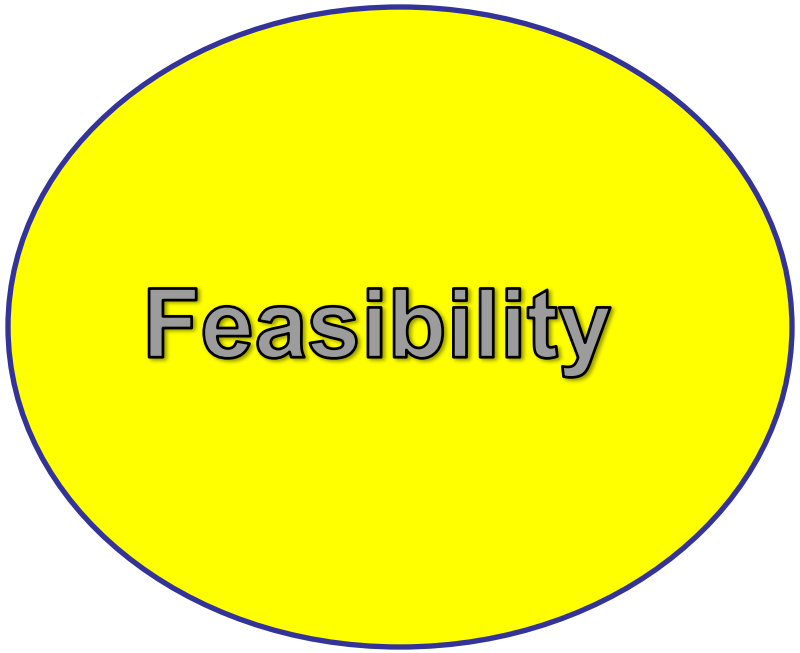
Engineering programs must demonstrate that their students attain the following outcomes:

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) 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
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

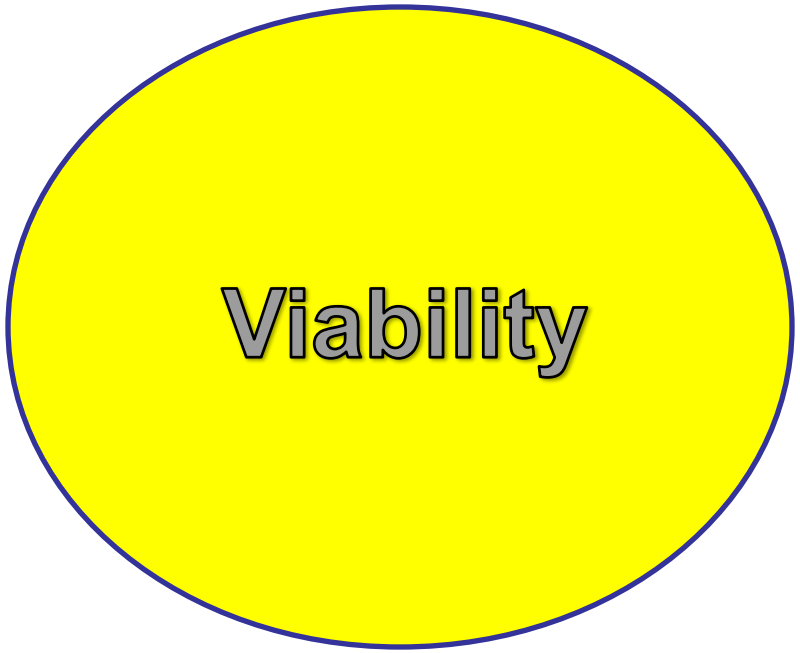
Engineering = **Innovation**

Innovation vs. Creativity

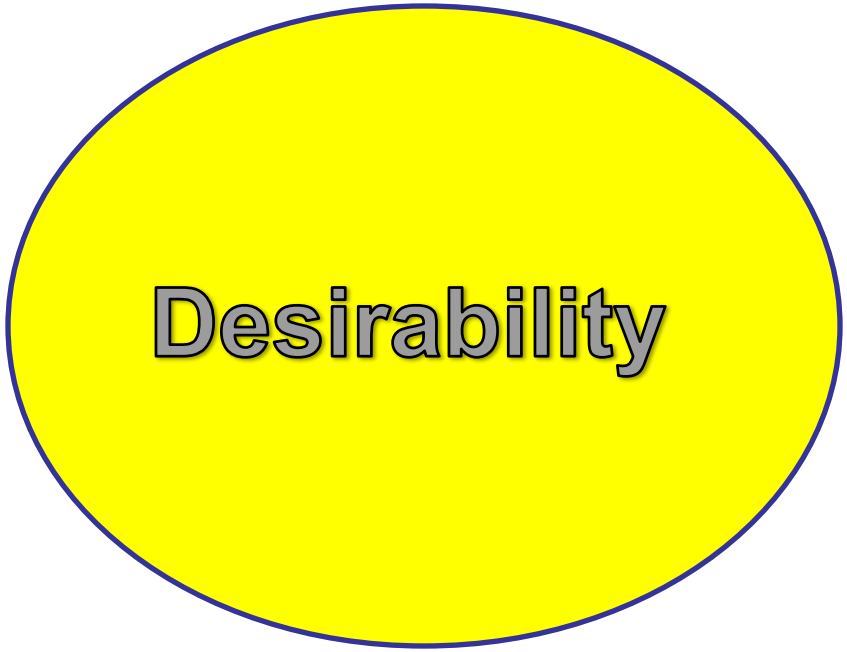
Engineering

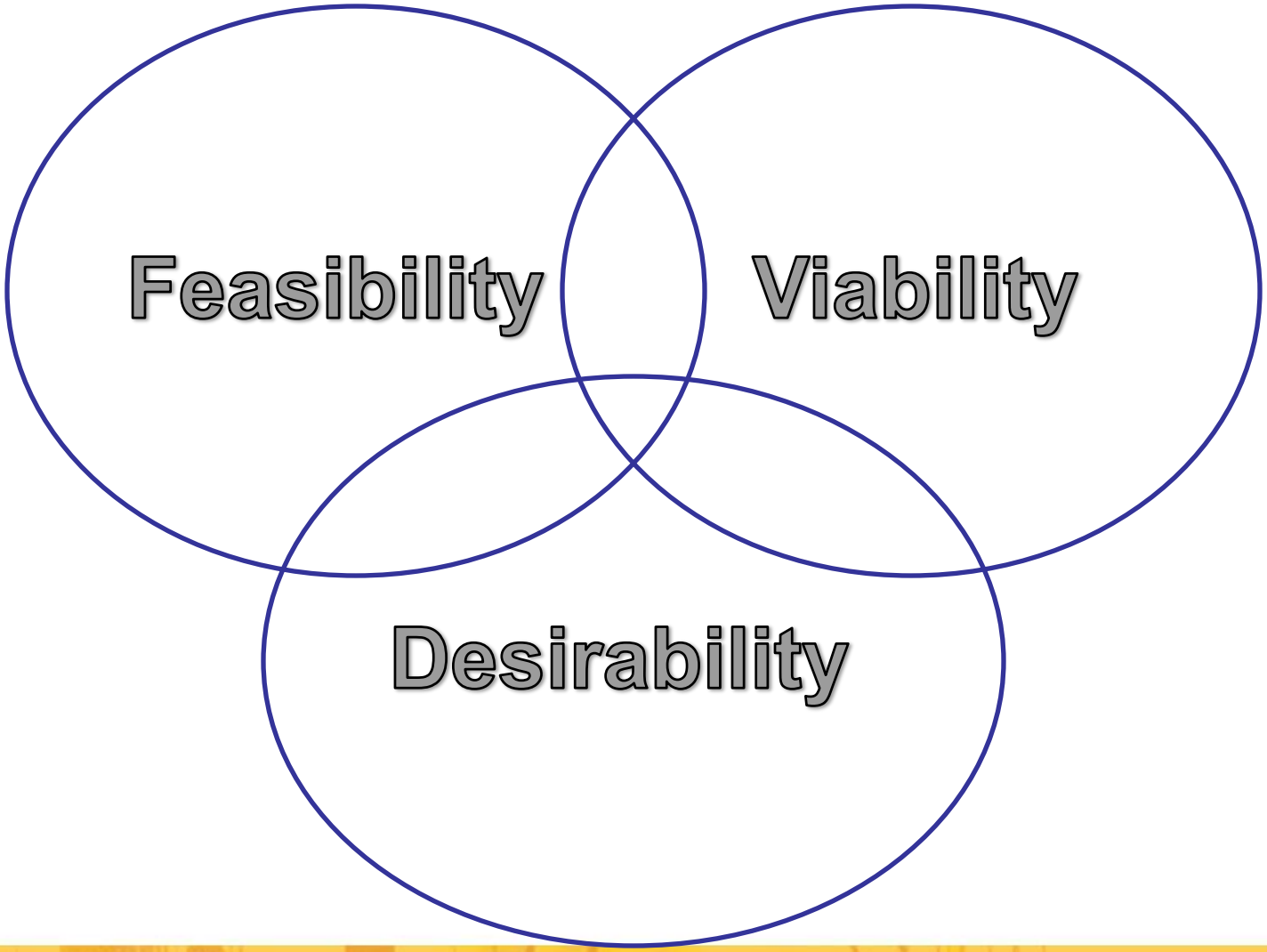


Business



Marketing





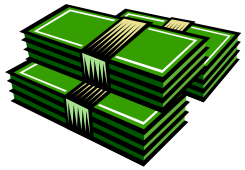
Teamwork

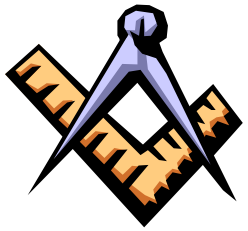
Communications

How to ask questions

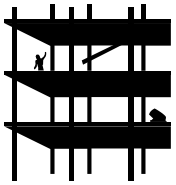
How to learn

Construction Engineering & Management





- Estimating
- Scheduling
- Construction Equipment
- Construction Methods



First Year Fall (14)

*ENC 1101 - Engl Comp I (3)
*MAC 2311 – Calc w/Analytic Geom I (4)
*SPC 1016 - Oral Comm for Engr (3)
*ECO 2013 *or ECO 2023* Economics (3)
EGN 1006 - Intro to Engr Prof (1)

First Year Spring (15)

*ENC 1102 - Engl Comp (3)
*MAC 2312 – Calc w/Analytic Geom II (4)
*PHY 2048/L - Physics Engr I/Lab (3/1)
*ANT/PSY/SYG or * GEO/GLY/BSC (3)
EGN 1007 - Engr Concept and Meth (1)

Second Year Fall (16)

*MAC 2313 – Calc w/Analytic Geom III (4)
*CHM 2045 - Chem Fund I (4)
*HUM/AMH/EUH - I (3)
EGN 3310 - Statics (3)
EGN 3613 - Engr Econ Anal (2)

Second Year Spring (16)

*MAP 3302 - Diff Eqns (3)
*CHM 2046 - Chem Fund II (3)
*PHY 2049/L – Physics Engr II/Lab (3/1)
*HUM/AMH/EUH - II (3)
EGN 3331 - Mechanics of Materials (3)

128 Credits

Summer (9)

*ANT/PSY/SYG or * GEO/GLY/BSC (3)
STA 3032 - Prob/Stat Engrs (3)
ENV 3001 - Intro to Envir Engr (3)

Third Year Fall (16)

EGN 3321 - Dynamics (3)
CCE 4003 – Intro to Construction (3)
CES 4100C - Structural Analysis I (4)
*SUR 2101 - Surveying (3)
EGN 3365 – Struc & Prop of Matls (3)

Third Year Spring (15)

CWR 3201 – Eng Fluid Mechanics (3)
*Cultural/Historical Elective (3)
CES 4702 Concrete Structures (3)
CCE 4004 Construction Methods (3)
Engineering Science Elective (3) *see note*

Fourth Year Fall (15)

TTE 4004 - Transportation Engr (4)
CEG 4101C - Geotechnical Engr (4)
CCE 4034 Constr Estim. and Sched. (3)
CCE 4813 Mech. & Elect. Sys for Bldgs. (4)

Fourth Year Spring (12)

ACG 2071 Managerial Accounting (3)
CCE 4402 Constr Equipt. & Prod. (3)
CEG 4801C Geotechnical Design (3)
CCE 4810 Constr Engr Desg Project (3)

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Construction Engineering

- First two years are common among CECE
- Six Courses & Managerial Accounting
  - CCE 4003: Intro to Construction
  - CCE 4004: Construction Methods
  - CCE 4034: Estimating & Scheduling
  - CCE 4402: Construction Equipment
  - CCE 4813: Mech. & Elect. Systems
  - CCE 4810: Construction Design

Reduce Costs

Which Costs?

National Aeronautics and Space Administration

System Failure Case Studies

OCTOBER 2008 Volume 2 Issue 8

THAT SINKING FEELING

On March 20, 2001, the largest offshore oil production platform in the world sank to the bottom of the ocean about 150 kilometers off the coast of Brazil. A series of explosions claimed the lives of 11 crew members and crippled one of the four main support columns, which resulted in the massive flooding of Petrobras Platform 36 through an improbable but devastating chain of events. Approximately 1,200 m^3 of diesel oil and 300 m^3 of oil spilled into the Atlantic Ocean's Campos Basin, and the $496 million rig was declared a total loss.

BACKGROUND

The Petrobras Platform 36 (P-36) oil rig was originally built in 1994 as a drilling platform but was later converted to a deep-water semi-submersible production platform to service a different offshore oil field than initially intended. Modifications for the con-

Figure 1: Petrobras P-36 sinks into the Atlantic Ocean.

"THE PROJECT SUCCESSFULLY REJECTED ... PRESCRIPTIVE ENGINEERING, ONEROUS QUALITY REQUIREMENTS, AND OUTDATED CONCEPTS OF INSPECTION ..."

A PETROBRAS EXECUTIVE, PRIOR TO THE ACCIDENT, ON DELIVERING SUPERIOR FINANCIALS

The Future

- To be the premier construction program in Florida.
- To develop cutting edge research in Infrastructure applications.

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THANK YOU!

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