Determining Minimum Competency: Education, Examination, and Experience

NCEES Past President
David L. Whitman, Ph.D., P.E.
Goal of licensing requirements

• To determine whether an individual is minimally competent to practice engineering
  – They must demonstrate that they have the basic knowledge required to practice without endangering the health, safety, and welfare of the public.
P.E. license requirements

3-legged Stool
- Education
- Examinations
- Experience
Education

• Degree from EAC/ABET-accredited program or the equivalent
  – Equivalent: As compared to NCEES Engineering Education Standard
  – Bachelor’s or master’s degree may be acceptable, depending on jurisdiction

• The education requirement exists so that state boards can verify that an individual has the knowledge base for entering the profession.
Examination

- Provides for a uniform measure of competence
- Multiple exams required
- NCEES develops, administers, and scores these licensing exams.
Exams

• NCEES licensing exams are used by all 50 states, D.C., Guam, Puerto Rico, and the U.S. Virgin Islands.

• The exams are also administered in several other countries.
  – Canada, Egypt, Japan, Saudi Arabia, and South Korea
  – April 2012: Will begin offering exams in Turkey and the Emirate of Sharjah.
Fundamentals of Engineering exam (FE)

• Tests academic knowledge
  – Usually taken just before or after graduation.
  – Most states allow college seniors within one year of graduation to take the exam.

• Currently offered in April and October
  – Will be more frequent when exam moves to computer-based testing in January 2014.
FE exam format

- 8-hour, multiple-choice exam
- Closed-book except for supplied reference manual
- Morning and afternoon sessions
  - 120 questions in morning
  - 60 questions in afternoon
FE exam morning session

• General questions covering science, math, and engineering basics
  – 15%: Mathematics
  – 10%: Engineering Mechanics (Statics, Dynamics)
  – 9% each: Chemistry, Electricity & Magnetism
  – 8%: Engineering Economics
FE exam afternoon session

- Choose from 7 modules
  - Chemical
  - Civil
  - Electrical
  - Environmental
  - Industrial
  - Mechanical
  - Other Disciplines
FE exam

• 50,000 examinees each year
• Once you pass, you are an engineer intern, or E.I.
  – Ready to begin professional training
Experience

• Generally, need to work under the supervision of a P.E.

• Four years of progressive experience
  – Increasing quality
  – Requiring greater responsibility

• Most states require you to complete this experience before applying for the final licensing exam.
Principles and Practice of Engineering exam (PE)

- Final licensing exam
- Tests knowledge gained through experience
- Currently, exams offered every April and October
  - Some only offered once a year
- 22 different exams currently offered
- Other exams can be added
PE exam disciplines

- Agricultural
- Architectural
- Chemical
- Civil
  - Construction
  - Geotechnical
  - Structural
  - Transportation
  - Water Resources and Environmental
- Control Systems
- Electrical and Computer
  - Computer Engineering
  - Electrical and Electronics
  - Power
- Environmental
- Industrial
PE exam disciplines

- Mechanical
  - HVAC and Refrigeration
  - Mechanical Systems and Materials
  - Thermal and Fluids Systems
- Metallurgical and Materials
- Mining and Mineral Processing
- Naval Architecture and Marine
- Nuclear
- Petroleum
- Software Engineering (starting in 2013)
PE exam format

• 8-hour, multiple-choice exam
• Morning and afternoon session
  – 40 questions in each session
• Open book, with some restrictions on reference material allowed
  – In anticipation of moving to computer-based testing, working toward changing some exams to allow only supplied reference manuals
Some jurisdictions require specialized structural engineering licensure.

In 2011, NCEES introduced a new exam that could be used by any of these jurisdictions, including areas with high seismic activity.
SE exam format

• 16-hour exam with two 8-hour components
  – Vertical Forces component (Friday)
    • Gravity loads and lateral earth pressures
  – Lateral Forces component (Saturday)
    • Wind/earthquake loads
• Morning session: 40 multiple-choice questions
• Afternoon session: 3-4 essay questions (choose buildings or bridges module)
SE exam

• Must receive an acceptable score on both Vertical and Lateral components to pass the SE exam
  – Doesn’t have to be in the same weekend, but must be within a 5-year window
P.E. license requirements

1. Education
2. FE exam
3. Experience
4. PE exam
Joining the engineering profession

• Once you complete licensure requirements and get licensed by a U.S. state or territory, you are a professional engineer (P.E. or S.E.)
  – Ready to assume privileges and responsibilities of being a licensed professional