Industrial Engineering

Linking People, Processes, and Technology

Engineering Disciplines

- Aerospace Engineering
- Chemical Engineering
- Civil Engineering
- Electrical Engineering
- Mechanical Engineering
- Petroleum Engineering
- but… what is Industrial Engineering?
  
  – Identity Crisis??????????
IE’s Put It All Together

- IE’s design systems / processes
- System: a set of related things working together to achieve a goal
- Systems Analysis: engineering techniques that “break down” complex systems into basic elements to evaluate relationships
  - Technical, social, biological systems

System Exercise

- Examples of systems
- Pick a system
- What are the components??
System Components

- People
  - Customers / Users
  - Employers
  - Managers
- Materials
  - Raw Materials
  - Products
- Facilities

System Components

- Equipment
- Processes
- Energy
- Money
  - Financing
  - Entrepreneurs
- Transportation
- Communication
Problems for IE’s

- How are millions of packages sorted and shipped around the world overnight?
- How should hospitals schedule staff to improve patient care?
- How is sheet metal converted to form a car or airplane?
- How are computers and cell phones designed to fit users needs and abilities?

Industrial Engineering

- Broad range / complex problems
  - People and technology
- Total systems approach
  - Scientific method
  - Engineering design
  - Technology integration
  - Create value
- Foundations in Math and Science
  - Math, Physics, Chemistry, Engr. Fundamentals
How Does IE Differ?

- Broadest engineering discipline
- Systems approach
- Inclusion of the human element
  - Life sciences
  - Social sciences
- Address the quality of life
  - Customers
  - Workers

What Do IE’s Do?

- Design cars for disabled drivers
- Create software for satellite-based routing of delivery trucks
- Design crew areas for the international space station
- Automate assembly lines for cars
- Manage technical projects/people
### What Do IE’s Do?

- Develop tests for worker screening
  - *Initial employee selection*
  - *Readiness-to-Perform assessments*
- Select locations for ambulance, fire, and police stations
- Reduce waiting times for rides at amusement parks
- Manufacturing of parts to specification

### Where Do IE's Work?

- United Parcel Service
- Alcatel
- MCI WorldCom
- Global Concepts
- IBM
- Exxon Mobil
- Oklahoma Natural Gas
- Lockheed Martin
- Arthur Andersen
- Texas Instruments
- Southwestern Bell
- Compaq
- General Motors
- Hitachi
- XEROX
- York International
- Fossil
- Hilti
- ESP
- small business
IE Salaries

- **Entry level salary**
  - $42,000 in 1999 (most recent survey)

- **Experienced IE salary**
  - $70,000

- **Top-level IE’s**
  - $400,000 or more
  - *Early promotion to leadership positions*
  - *Training in engineering problem solving*
  - *Many CEO’s are Industrial Engineers*

IE Topic Areas

**Ergonomics**

- **Ergonomics /Human Factors**
  - *Safety and health*
  - *Usability and efficiency*
  - *Product design*
  - *Job / work design*
  - *Performance assessment*
  - *User interfaces*
  - *Keyboards, displays*
  - *Special populations*
IE Topic Areas
Operations Research

- **Modeling**
  - Problem formulation
  - Feasible solutions
  - Optimal solutions

- **Production**
  - Systems and operations

- **Logistics**
  - Supply chains

- **Facility Design**

IE Topic Areas
Manufacturing

- **Processes**
  - Casting, forming
  - Machining
  - Computer-Aided Design
  - Computer-Aided Manufacturing

- **Materials**

- **Equipment/Tools**

- **Measurement**

- **Tolerancing**
IE Topic Areas
Simulation

● Modeling
  – Aircraft escape
  – Amusement park lines
  – Fast-food servers
  – Traffic flow / congestion

● Analysis
  – Mathematical formulations
  – Computer solutions

Wireless EMC Center

● How do cell phones interact with other electronics?
● Planes, Pacemakers, Defibrillators, Hearing Aids, etc.
● NSF Industry/University Cooperative Research Center
● Industry Sponsored
Human Technology Interaction Center

- Study the interaction between humans and various types of technology
- Multi-disciplinary center
- Summer Research Experience for Undergraduates
  - Cognitive Psychology
  - Communications
  - Computer Science
  - Education
  - History of Science
  - Industrial Engineering
  - Library & Information Studies
  - Management Information Systems
  - Social Psychology
  - Statistics

Why IE at OU?

- Among the best programs in the United States
- Faculty have experience in industry and government labs
- Faculty excel in research and classroom education
- Low student-faculty ratio
  - Students work with faculty to solve problems
Why IE at OU?

- Research opportunities for juniors and seniors (50%)
  - Human-technology interaction
  - Manufacturing
  - NASA space ergonomics research
  - Electromagnetic compatibility of cell phones
  - Engineering education

- Senior design capstone course
  - Solve real-world problems at local company

Why IE at OU?

- Professional experience
  - Teamwork skills
  - Communication skills – technical writing, formal presentations

- OU IE graduates hold high-ranking positions in
  - Major corporations and small businesses
  - Manufacturing, hospitals, airlines, banking
  - Universities and government agencies
IE Student Diversity

- Multi-national / multi-cultural
- Unique gender statistics
  - Undergraduate students: 50-50 women/men
  - Faculty: 40% women
  - For the past five years: 6% annual increase in female enrollment
  - Compare with 19% women national average across all engineering programs

IE Curriculum Options

- **Standard Option** (0913A)
  - Modern curriculum
  - 125 hours with 16 hours per semester
  - All IE core prior to capstone course

- **Information Technology Option** (0913B)
  - Provides IE degree with IT / CS emphasis
  - Provides minor in Computer Science
  - 132 hours includes 22 total hours of CS
  - Allows easy transfer from Computer Science
IE Standard Option

- Modern curriculum
  - *Engineering Fundamentals*
    » Statics and Dynamics, Materials, Thermo, Circuits
  - *IE Core*
    » Ergonomics, Manufacturing, Operations Research
    » Production, Simulation, Quality Control
    » Applied Research Methods, Communication Skills
  - *IE Capstone Experience*
    » Industrial project (manufacturing, service)
  - *IE Electives*

IE Info Tech Option

- IT Option (only 7 additional hours)
  - Courses exchanged
    » Technical Elective - satisfied by CS elective
    » Math Elective - satisfied by CS 1823, Discrete Math
    » IE Electives - six hours replaced with CS electives
  - Courses added
    » CS 2334 - Programming Structures
    » CS 2413 - Data Structures
BS/MS IE Degrees

- Provides accelerated MS degree to outstanding undergraduate students

Eligibility requirements
- Junior standing in IE based on hours remaining
- GPA of 3.25 or above
- Full-time student

Credit Hour Count

- Degrees obtained separately
  - BSIE: 125 hours
  - MSIE: 30 hours
  - Total: 155 hours

- Degrees obtained simultaneously
  - Double count 12 hours of 5000 level courses
    » IE 5563, IE 5853, IE Elective, IE Elective
  - Total: 143 credit hours
Credit Hour Strategy

- **Seniors enroll in 5000-level courses**
  - IE 4563 > 5563 - Quality Engineering
  - IE 4853 > 5853 - Applied Research Methods
  - IE Electives - graduate core / other courses

- **Additional requirements for MS**
  - IE Electives - 12 hours (graduate core / others)
  - Research Thesis - 6 hours

So Why Not IE?

- **Outstanding students**
  - Several national awards each year: National Merit Scholars, Hispanic Scholars,
  - Outstanding College of Engineering Senior for 2001-2002: Jennifer Hayes (IE)

- **Outstanding faculty**

- **Scholarship opportunities (1/3)**

- **Solid curriculum options**

- **Outstanding career**
Hank Grant

- University of Oklahoma
  - Dugan Professor, Industrial Engineering
  - Director, Wireless EMC Center

- Education
  - Purdue University BSIE, MSIE, PhD

- Teaching
  - IE 2823 Enterprise Engineering
  - IE 5673 Industrial Applications of Simulation
  - IE 6663 Seminar in Simulation Research

- Industry
  - President, Factrol, Inc.
  - VP, Pritsker Corporation
  - Director, HP Labs,
  - Program Director, National Science Foundation
And after teaching:

- Fishing in the Gulf Stream
- Hiking at 3,000 meters
- Kids in San Luis Potosi
- Kids in Haiti