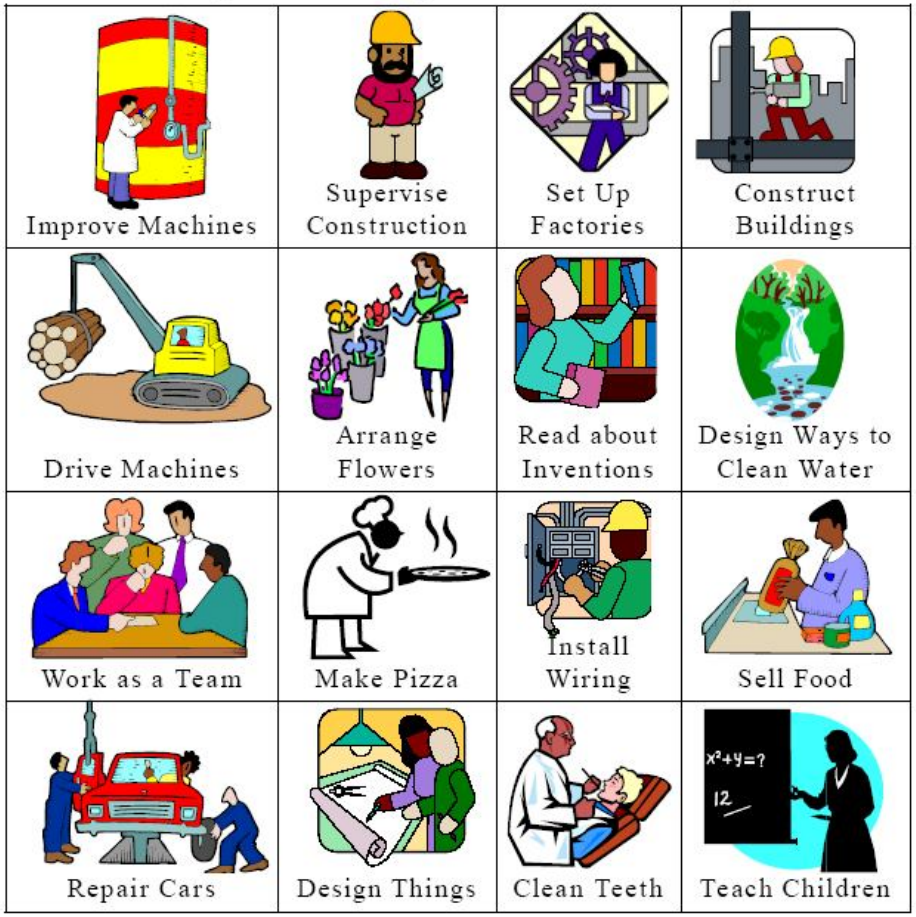
Introduction to Engineering

Engineering Misconception—I

What is an Engineer?

What kinds of work do engineers do? Circle the kinds of work that you think engineers do for their jobs.



From: http://www.mos.org/eie/pdf/research/Pipeline_EiE_evaluation_0405_final.pdf

Engineering Misconception—II

Which of these things are examples of technology?

How do you know something is technology?

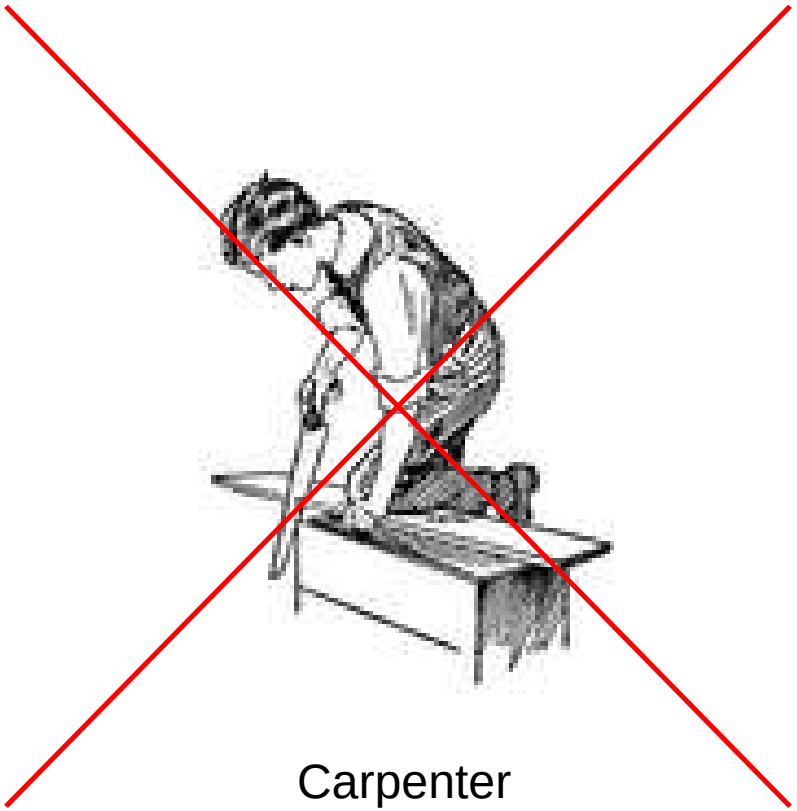
From: http://www.ciese.org/eofnj/docs/ResearchEiE.pdf

Engineering Misconception—III

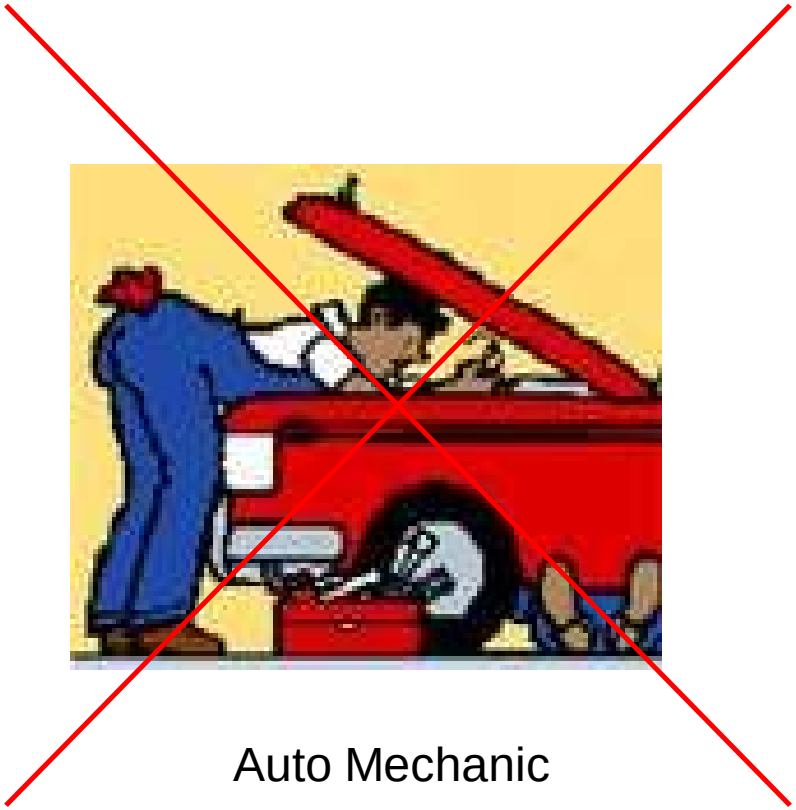
Plumber

Electrician

Engineering Misconception—IV



Carpenter



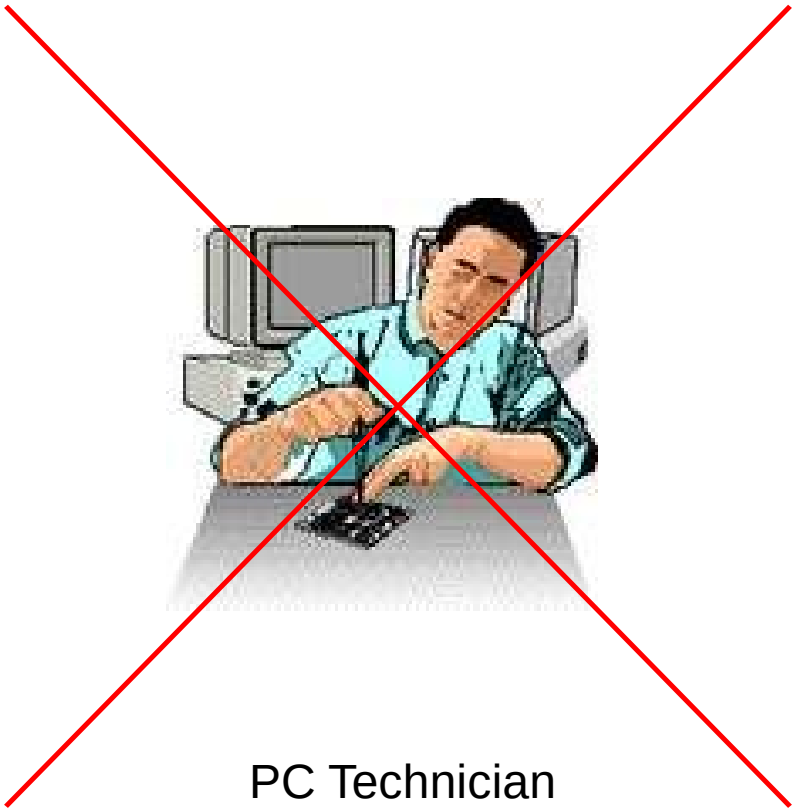
Auto Mechanic

Engineering Misconception—V

Train Operator

Printing Press Operator

Engineering Misconception—VI



PC Technician

Building Supervisor/Handyman

Engineering Misconception—VII

Welder

Machinist

Engineering Misconception—VIII

Science v/s Engineering

- Science:
  - Investigation, understanding, and discovery of nature, its composition, and its behavior (i.e., “laws of nature”)
  - Why
  - Build (experiments, tools, devices, etc.) to learn
- Engineering:
  - Manipulating the forces of nature to advance humanity
  - How
  - Learn to build (products and services useful for humans)

What is Engineering—I

- Engineering: Latin root, ingeniere, to design or to devise
- Engineering is <u>design</u> under constraint

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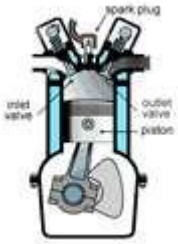
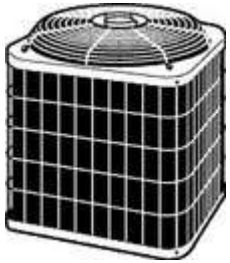
device, component, subsystem, system such as

Airplane



Engine



Air Conditioner

Heart Valve

Skyscraper

Microcontroller

Prosthetics

Bridge

What is Engineering—II

- Successful engineering design improves quality of life while working within technical, economic, business, societal, and ethical constraints.
- Technology: Outcome of engineering

Engineering Defined—I

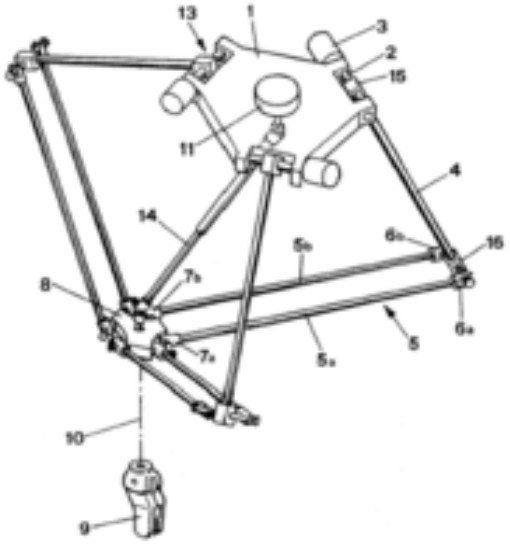
- Profession in which knowledge of math and natural sciences, gained by study, experience, and practice, is applied with judgment to develop ways to use, economically, the materials and forces of nature for the benefit of mankind.
  - Accreditation Board for Engineering and Technology (ABET)

Engineering Defined—II

- Profession
- Math and natural sciences
- Knowledge acquired by study, experience, and professional practice
- Knowledge applied with judgment
- Attention must be paid to constraints (economic, materials, forces of nature)
- Benefit of mankind
- Not based solely on trial, error, intuition

Mechanical Engineering

Machinery, Production, Manufacturing



Machines & Mechanism

Manufacturing

Mechanical Engineering

Analysis & Design

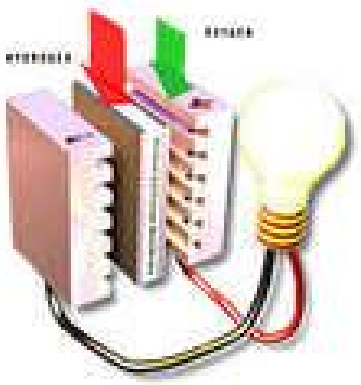
Aerodynamic Design of Vehicles

Compute Aided Analysis & Design

Mechanical Engineering

Energy

Wind Energy



Fuel Cell

Mechanical Engineering

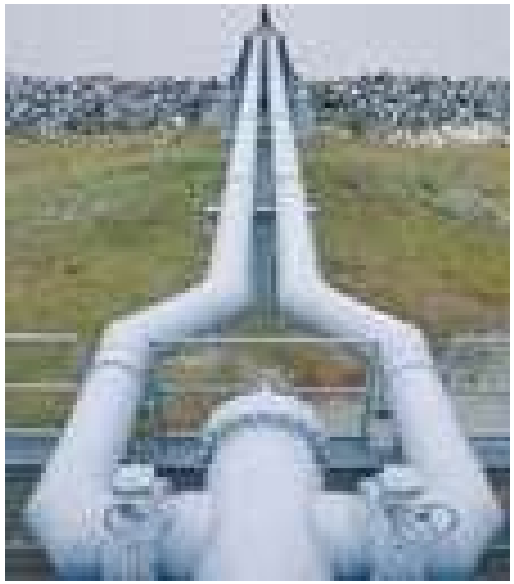
Air & Space

UAV

Space Shuttle

Mechanical Engineering

Systems



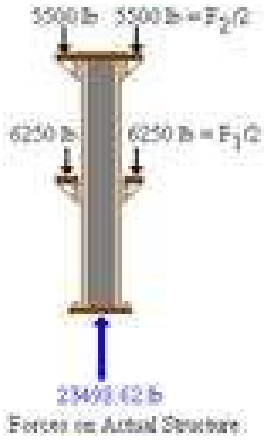
Utilities

Robotics

Civil Engineering

Analysis & Design

Foundation



Structural Analysis

Civil Engineering

Construction

Bridge

Skyscraper

Tunnel

Civil Engineering

Environmental

Water Treatment

Civil Engineering

Systems

Transportation

Utilities

Electrical Engineering

Electricity

Electrical Engineering

Electrical & Electronic Circuits

Electrical Engineering

Motors & Generators

Motor

Generator

Electrical Engineering

Instruments

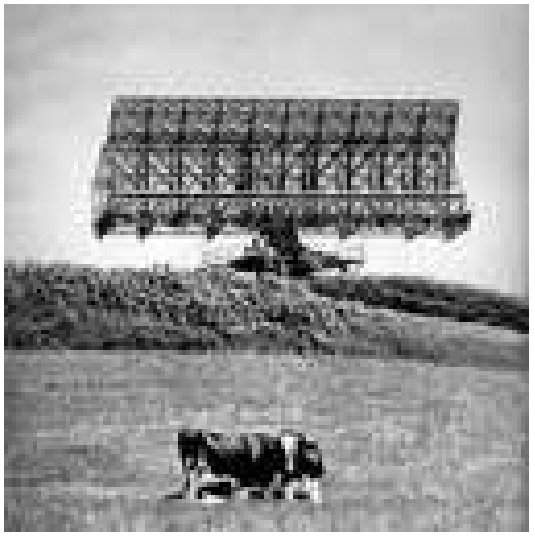
Power Supply

Oscilloscope

Measurement

Electrical Engineering

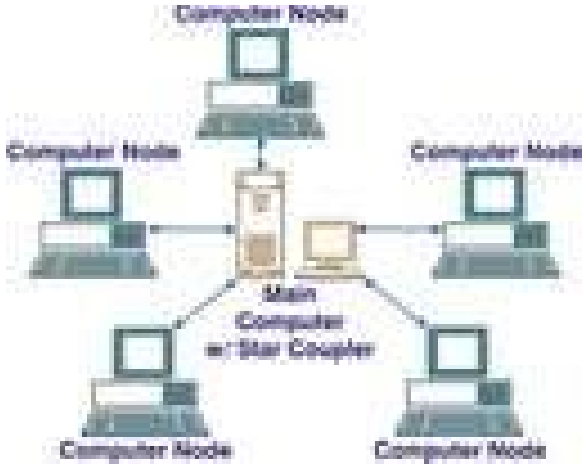
Radar



Electrical Engineering

Communication & Networks

Communication



Network

Engineering Majors

- **Aerospace**
- **Agricultural**
- **Architectural**
- **Bioengineering**
- **Biochemical**
- **Biomedical**
- **Ceramic**
- **Chemical**
- **Civil**
- **Computer**
- **Construction**
- **Cryogenic**
- **Electrical**
- **Electronic**
- **Environmental**
- **Industrial**
- **Manufacturing**
- **Materials**
- **Mechanical**
- **Mechatronics**
- **Metallurgical**
- **Mining**
- **Naval**
- **Nuclear**
- **Petroleum**
- **Software**
- **Structural**
- **Systems**
- **Textile**
- **Tissue**

What Engineers Do—I

- **Research: Advance field**
- **Development: Lab to market**
- **Testing: Verify integrity, reliability, quality**
- **Design: Develop specs for manufacturing, construction, etc.**
- **Analysis: Use math models to aid in R&D**
- **Systems: Integrate components to produce functioning product Manufacturing: Develop plants and process to make products**
- **Construction: Build**

What Engineers Do—II

- **Facility/Plant Operation**
- **Maintenance**
- **Technical Support**
- **Customer Support**
- **Sales**
- **Consulting**
- **Management**
- **Others**

Why Engineering in K-12

- **Real-world engineering applications and examples concretize complex math and science concepts**
- **Students are engaged in experiential learning**
- **Students' creativity is challenged, developed, and enhanced**
- **Students' soft skills in communication and team-work are developed**
- **Students are better equipped for college-level work and can become active participants in an increasingly technological society**