Teaching Engineering

Locally Designed Program

• Three aspects
  ▫ Engineering concepts and theory with math
  ▫ Hands on applications of the theory, with measurement and/or evaluation
  ▫ Writing – documenting the process and results

• Two levels
  ▫ Year 1: Fundamentals, several topics, small projects
  ▫ Year 2: Long term and competitive projects
Intro to Engineering - topics

First Quarter
- Engineering Design Method
- Systems Engineering
- Engineering Societies
- Patent Law
- Project Management
- Entrepreneurship

Second Quarter
- Mechanical Engineering
  - machines
- Structural/Civil Engineering
- Heat Transfer
- Chemical Engineering
- Engineering Games/Toys

Third Quarter
- Electrical Engineering
  - DC circuits and motors

Fourth Quarter
- Special topics
  - Solar energy
  - Hydrogen cars
  - TEAMS/TSA
- Acoustical Engineering
  - Build instruments
- Final Project/Presentation
  - Analyze "How it's Made" for
  - Systems/patents/management
  - Entrepreneurship

Engineering - Long term projects

Students typically have more than one project

Team Projects include:
- FIRST Tech Challenge
- Panasonic CDC
- TEAMS and TSA
- Young Science Achievers Program, YSAP

Solo projects include:
- Projects continued from summer internships
- Student proposals
- Also YSAP
RET - Summer 2012

Two projects:
1. Create a database of coated powder properties to validate a mathematical model that can predict bulk properties based on the host and guest particle characteristics
2. Create a blends database showing the effect of coatings on each of the components, the API and major excipients, on the bulk properties of the blend

What RET brings to my classroom this year

Fluid Mechanics: use Fluid Power Lab and add-ons
• Hydraulics – project 1
  ▫ Hydraulic Arm build lab – (Teacher Geek)
  ▫ Evaluate and test arm for mechanical advantage
• Pneumatics – project 2
  ▫ Demos with table top compressor and vacuums
  ▫ New kit for the FTC team – demo in January
• Solids fluidization – project 3
  ▫ Build solids fluidization box with interchangeable plates. Test with various materials.
Hydraulics - Project 1

Hydraulic Arm model from kit
- 3 directional pistons
- 1 claw control piston

Learning experience includes
- Design
  - the kit has several variations
- Hand skills, planning, construction
- Measurement
- Use of Engineering notebook

Solids Fluidization - Project 3

Construction Plan

- Fluidization Box
- Porous Steel Plate
- Air line
- Table top Compressor
- Air pressure chamber
- Releasable clamp holds the box together
Lessons for Solids Fluidization
NJCCC 8.2

- Students will observe and understand how the device works
- Student will vary the plate types and measure how the difference in air flow affects fluidization
- Students will vary the air flow rate
- Students will fluidize various materials
- Students will optimize the fluidization parameters for each substance.
- Generalize the parameters needed to fluidize

Assessment of Student Work

1. Engineering notebook
   - General format, eg. page numbers, dates
   - Orderly data tables, all entries identified
   - Comments and reflections on observations
2. Written assignments
   - Reports, solo and team based
3. Oral presentations and/or demonstrations
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