

Engineering for Businessfolks
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Some Principles

- * Make dangerous, not engineers
- * Reality, not ivory tower
- * Teams and individuals, not just individuals
- * Technology drives, science-math follow
- * Breadth first, detail later (or not at all)
- * Articulate the unarticulated

Six Courses (or modules)

- * Graphics, Ingenuity, and Design
- * Gizmos: A Gentle Introduction to the People, History, Products, and Processes of Technology
- * A Sense of Number, Dimensions, and Modeling in Engineering Analysis
- * Engineering Processes: Making Quality Products and Services
- * Measurement in Engineering
- * A Survey of Modern Engineering Materials

Engineering Graphics, Ingenuity, and Design

- * Multifaceted nature of drawing, and the culture of engineering
- * Tool usage - hand tools, pencils, straight edge, triangles, parallel edge
- * Tool usage - CAD package, correspondence to drawing by hand
- * Napkin talk - freehand sketching, right-brain, left-brain
- * 3D rendering - perspective, isometric, oblique projections
- * Orthographic projection
- * Reading drawings
- * Manufacturing, CAM, tolerances, and costs, shop processes
- * Individual design project
- * Team design project

*connection
to ME275*

Gizmos: A Gentle Introduction to the History, People, Building Blocks, and End Products of Technology

- * A Brief History of Technology
- * Heroes of Technology (interspersed)
- * A survey of key building blocks in different areas:
 - structural: column, beam, dome, arch, reinforced concrete, steel, aluminum, alloys, connection, pretensioning
 - mechanical: spring, lever, gear, wheel, linkage, pendulum
 - flow: pipe, pump, valve, storage, airfoil, screw, piston
 - chemical: differential distillation, reactors, catalysis, (what else)
 - heat: heat exchanger, fin, radiator

*Linkage to Business
Inventors & Technology*

Industrial affiliates

- electronics: resistor, inductor, transistor, diode, amplifier, oscillator
- electromagnetics: solenoids, motors, generators, transformers
- logic: gates, inverter, multiplexer, (what else)
- controls: feedback loop
- software: interface subroutines, numerical subroutines, symbolic subroutines, adaptive subroutines. computation routines
- * Inside an Automobile: explore major systems and principles of operation
- * Inside a Petroleum Refining Plant (or a sewage treatment plant)
- * Inside an AM Radio (xmt & rcv)
- * Inside a Personal Computer
- * Inside an Operating System

TOOLKIT

A Sense of Number, Dimensions, and Modeling in Engineering

successive

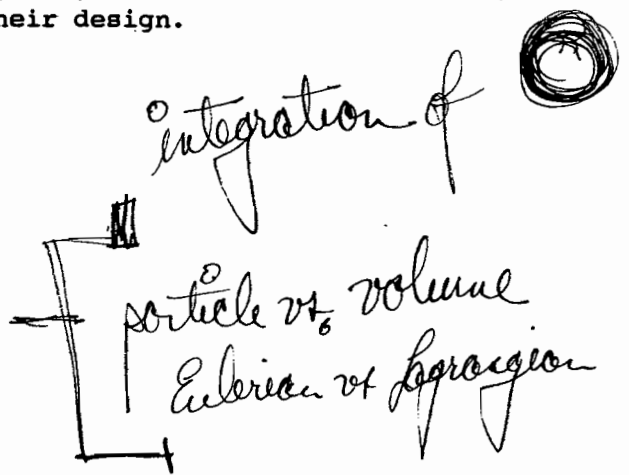
- * Number, approximate calculation, orders of magnitude
- * Dimensions, units, conversions
- * Complexity of calculations
- * Geometry as modeling - sines, cosines, areas, volumes
- * Black boxes, voltages, and currents - modeling networks of resistors, equivalent models
- active networks
- * Equilibrium, forces, and geometry - statics, trusses, free-body diagrams (model abstraction)
- * Deformation and strength - Hooke's law, stress and strain, safety factors, buckling, and fatigue.
- * Dynamic equilibrium, pressure, and flow - what goes in, comes out, bookkeeping, energy along a streamline, Bernoulli effect, lift, drag, separation, vortices.
- * On, off, and computation - logic circuit modeling, AND, OR, NOT, truth tables, minimal logic.
- * Equilibrium in chemical reactions (?)
- * Black-box transients - free and forced vibration in circuits, electrical-mechanical analogs.
- * Mechanisms and motion - $F = ma$, relative motion, centrifugal forces, free vibration, forced vibration,
- * Computation - Turing machines, computer programs, algorithms, complexity, and efficiency
- * Randomness and its modeling - probability, expectation, time-to-failure, quality applications, queues and their design.

*Signal Processing a lot of stuff
- break in two*

integration of

particle vs. volume

Eulerian vs Lagrangian



Engineering Processes: Making Quality Products and Services

- * Metal part manufacturing - casting, machining, finishing, etc.
- * Plastics part manufacturing - molding, etc.
- * Electronics component manufacturing - lithography, chips, etc.
- * Product assembly processes
- * Construction
- * Chemical processing
- * Models of processes
- * Theories of improvement - time and motion, operations research kaizen, TQM.

What's Going on Out There: Measurement in Engineering

- * Accuracy, error
- * Electronics in measurement - oscilloscopes, DVM, data acquisition
- * Length, time measurement
- * Velocity, acceleration measurement
- * Elongation measurement
- * Measurement in flow fields
- * Heat, temperature measurement
- * Visual inspection, optics, and imaging
- * Measurement in materials, destructive and NDT
- * Chemical measurement and instrumentation
- * Social systems measurement (?)

What's It Made Of: Modern Engineering Materials

- * Concrete
- * Wood and paper products
- * Metals
- * Plastics
- * Ceramics
- * Modern composites
- * Electronic materials

* Optical materials
* Magnetic materials