MECHATRONICS I & II

LECTURE NOTES

******* WEEK 1 *******

WEEK 1 - INTRO TO ENGINEERING

1.1 ABOUT ENGINEERING

Engineering is the systematic and creative use of **science**, **math**, & **technology** to design & produce efficient, economical "things" (machines, processes, systems, etc.). Science is the study of the natural world (e.g., physics, biology, chemistry, etc.). Math is the science of numbers.

There are 3 major fields of engineering: **mechanical**, **electrical**, and **civil**.

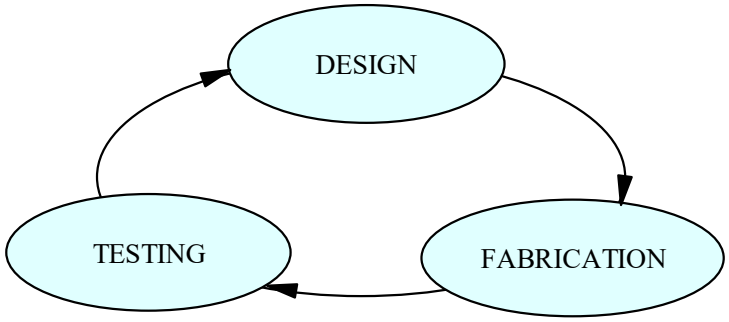
Mechanical – design mechanical systems (machines, cars, planes, robots).
Electrical – design electrical/electronic systems (cell phones, computers, TVs).
Civil – design public works or fixed structures (buildings, roads, dams).

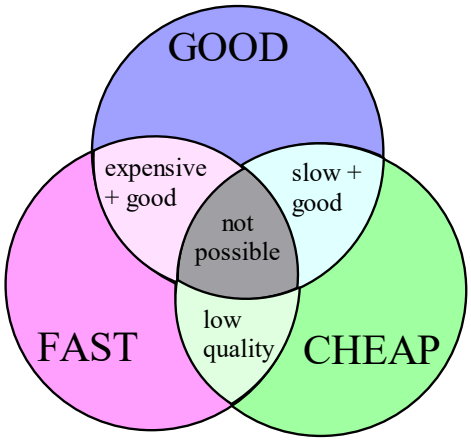
There are many other branches as well (chemical, aerospace, environmental, biomedical, and more).

The engineering design process is: **design**, **fabricate**, and **test**.

Design – engineered systems are conceived and detailed (engineers, technicians, designers, drafters)
Fabrication – designed systems are physically created (engineers, technicians)
Testing – fabricated systems are tested for performance (engineers, technicians)

Managers of engineering design projects must often make decisions given constraints of resources and time. It follows that one corner of the "design triangle" (below right) must always be sacrificed.





There are different jobs related to engineering.
Engineers – involved with all aspects of the design process.
Engineering technicians – mainly fabricate and test
Drafters – take engineer's designs and create technical drawings.

Engineers earn ~$100K per year and need a BS degree in engineering.
Engineering technicians earn ~$65K/yr and need an Associate Degree in Engineering Technology.
Drafters earn ~$63K/year and need an AS degree or certificate.

Career and labor market information (job projections, salary, work conditions, skills & education needed)
1. Bureau of Labor Statistic, Department of Labor (bls.gov/ooh) (national data)
2. Employment Development Dept., State of CA (www.edd.ca.gov) (CA data)

MODERN MANUFACTURING

Mechanical and electrical engineers are primarily employed in the **manufacturing** sector, where products and goods are created. Traditional manufacturing utilized skilled labor (tradesmen and craftsmen).
Modern manufacturing is a rapidly-advancing area, increasingly utilizing high technology like robotics and automation. Therefore, knowledge of mechatronics is becoming increasingly important.

The process of taking conceptual designs and making physical products is becoming much faster due to **rapid prototyping**. This technology takes the geometric information from models produced in CAD programs (like Solidworks) and sends them directly (or nearly directly) to manufacturing equipment (CNC machines, 3D printing, SLA, laser cutting, etc.).

Traditional manufacturing involved mostly skilled manual assembly. Increasingly manufacturers are turning away from such techniques and moving towards high technology industrial automation. This includes robot - computer-controlled machines and PLC's (programmable logic controllers). PLC controllers are basically industrialized computers specifically designed to sense and control industrial machinery. Common PLC brands are Allen Bradley and Siemens.
TECHNICAL TOPICS

REFER to the CT GUIDE on SAFETY

(SAFETY EXAM)

TOPICS IN OTHER GUIDES FOR THIS COURSE
Arduino - Ch 1 (Intro), Ch 2 (IDE), Ch 3 (Programming), Ch 4 (I/O, signals), Ch 5 (Serial monitor) Ch 6 (Timer), Ch 7 (no delay)
C Programming - Ch 1 (Intro), Ch 2 (Arduino), Ch 3 (Basics), Ch 4 (rel, if), Ch 5 (Logical oper's), Ch 6 (loops), Ch 7 (Fcns)
CT Guide

WEEK 2 - ELECTRICITY

REFER to the CT GUIDE (Chap 5) on ELECTRICITY