Electrical Engineering - A Family Tree

The Fundamentals

- -Mathematics -Physics
- -Chemistry
- -Writing

ECE Fundamentals

```
Circuit Analysis
     -KVL, KCL, Other analysis methods
     -AC and DC analysis
     -simulation tools
Electronics
     -semiconductor physics
     -behavior or common semiconductor devices
         -diodes, BJTs, JFET, MOSFET
     -semiconductor circuit analysis
         -DC, AC, temperature stability, large signal, small signal
Digital Logic
     -boolean algebra
     -minimization of logic
     -timing analysis, propagation delays
     -simulation tools
Computer Architecture
     -internal structure of computing hardware
     -machine level programming
     -performance metrics
Computer Programming
     -high level programming language usage
     -data structures
     -searching and sorting
     -algorithms, complexity and size/speed trade-offs
     -compilers
     -operating systems
Fields and Waves
     -electric and magnetic fields
     -practical implications of field and wave theory
Signals and Systems
     -relationships between time and frequency
     -noise, power, bandwidth,
```

ECE Areas of Emphasis

Semiconductors

-Semiconductor Processing, -Process Integration, -Devices and Materials -New Device Materials -Transparent Electronics (physics and chemistry)

Information Security/Coding

-Cryptography -Network Security -Error correcting/detecting codes (heavy mathematical basis, computer networking)

IC design

-Analog

-data converters
-RF circuits
-sensors

(circuit design, electronics, software, CAD tools)

-Digital
-complex digital functions
-microprocessors, digital signal processing, cryptograph

(circuit design, electronics, software, CAD tools)

Power Engineering

-energy conversion: motors, generators, adjustable speed drives
-power system analysis
-power electronics (DC -> AC conversion)
-photo voltaic cells
-wave energy
-power factor correction
(circuit design, physics, magnetics)

Communications

-modulation methods (AM, FM, SSB, NBFM, QPSK)
-higher BW and lower bit errors
-digital signal processing
-multimedia
-wireless communication and networks
(mathematics, circuit design, digital design, computer architecture)

Computer/Communication Networks

-topology of networks
-network protocols
-wireless networks
-network programming
-security of networks
(computer/network architecture, software programming, queueing theory)

Optics

-optical fibers -optical communication systems -coding for optical systems (*physics, circuit design, mathematics*)

Electromagnetic Fields

-electric and magnetic field behavior
-design of small, effective antennas
-transmission lines
-uWave antennas
-signal propagation
(mathematics, CAD tools)

Robotics

Artificial Intelligence Computer Graphics Real Time Operating Systems High Performance Computer Architecture/Languages

And many more.....