KNOWLEDGE INTEGRATION IN THE RED PROGRAM

Revolutionizing Engineering Departments

STEM EDUCATION NEEDS RADICAL, FUNDAMENTAL, AND STRUCTURAL CHANGES BEYOND THE EXISTING NORMS

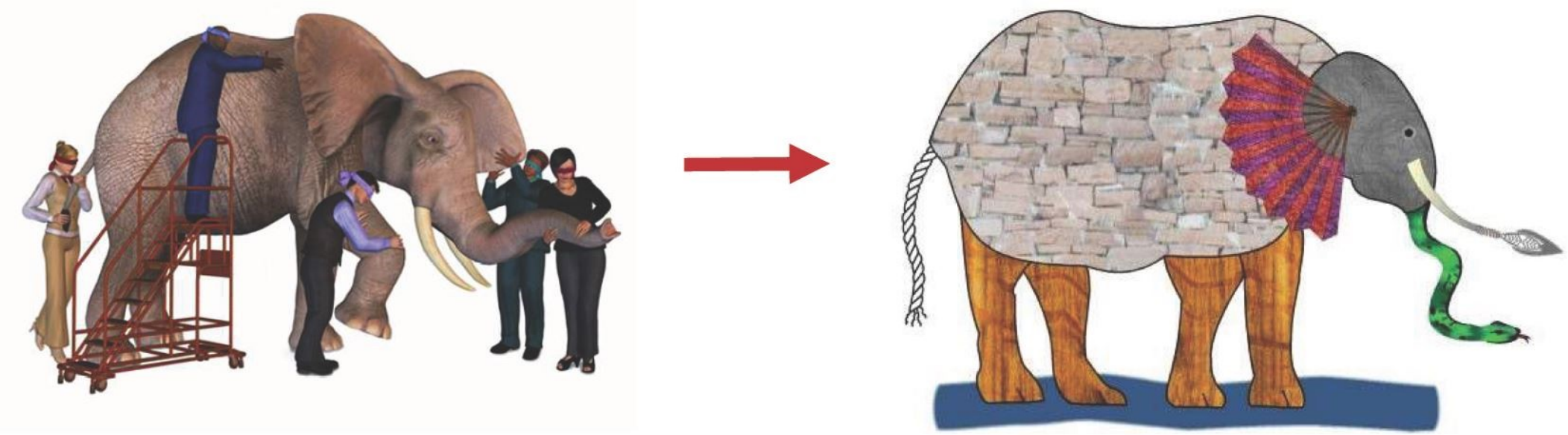
- 42% of jobs will be in risk with the status-quo STEM education (NEA data)
- Nationally, less than 50% of the students who enrolled in engineering curriculum complete the program. 30% of STEM students don't get degrees within 6 years.
  - At CSU, We typically lose about 40% of our engineering students in the first two years.

Why?

What are we going to do about it?

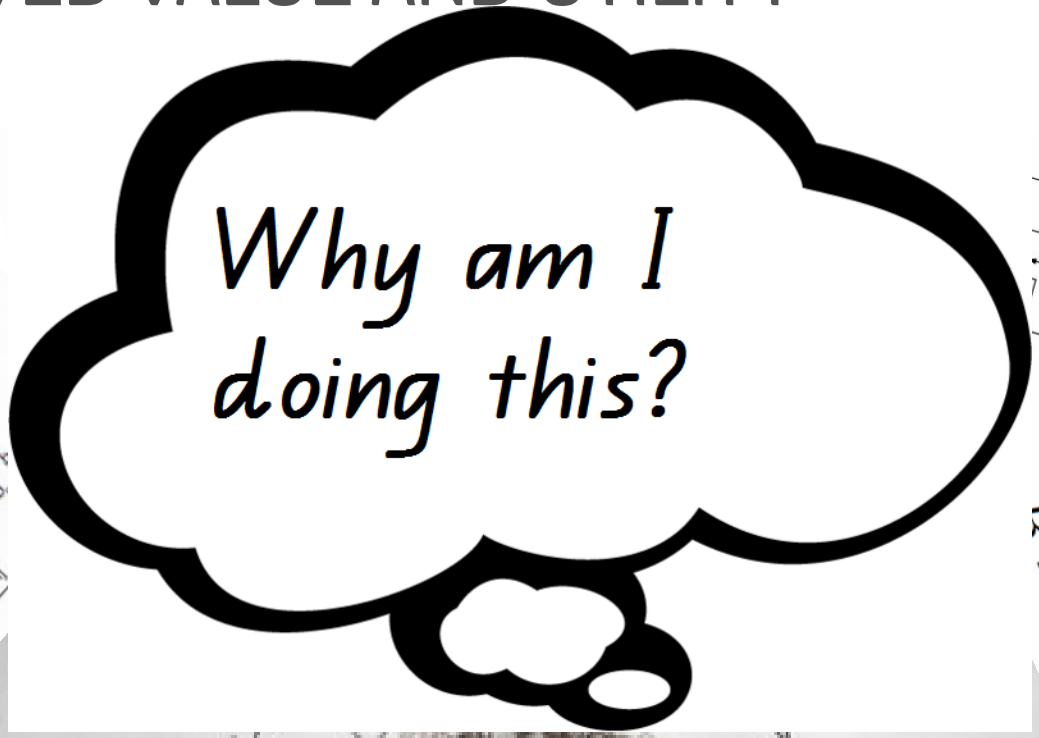
WE TEACH AND YOU LEARN IMPORTANT CONCEPTS IN SILOS

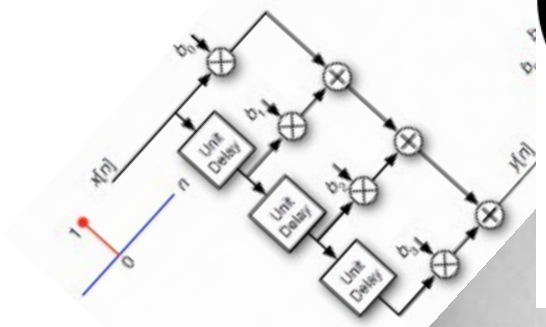
SEEING THE WHOLE PICTURE HELPS LEARNING INDIVIDUAL SUBJECT

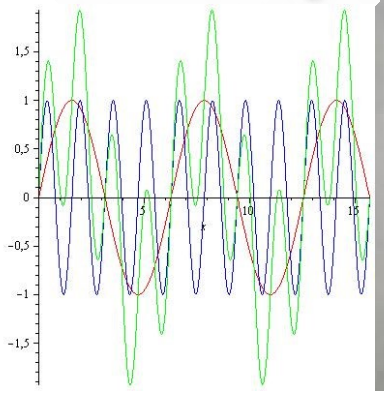


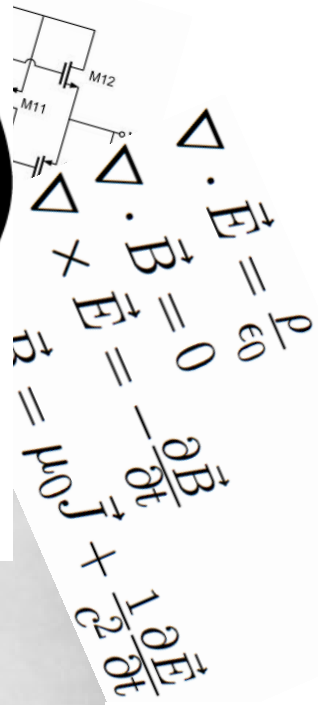
What is an elephant? Well, it depends on your perspective.

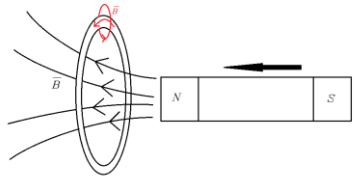
LACK OF PERCEIVED VALUE AND UTILITY











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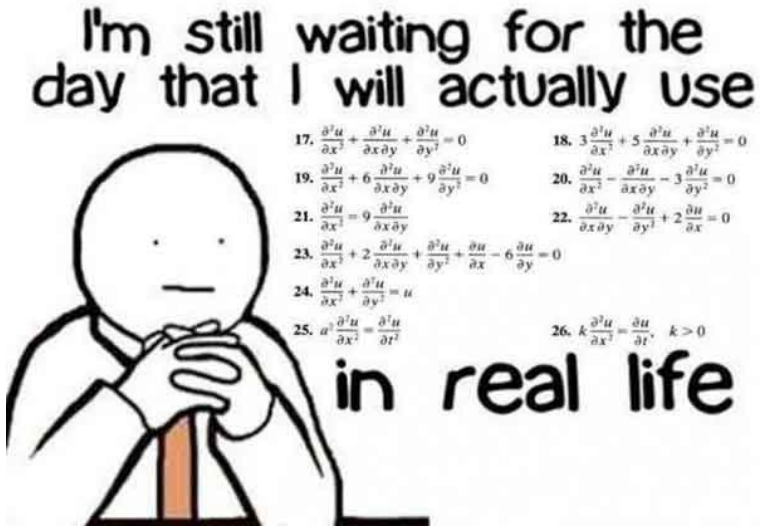
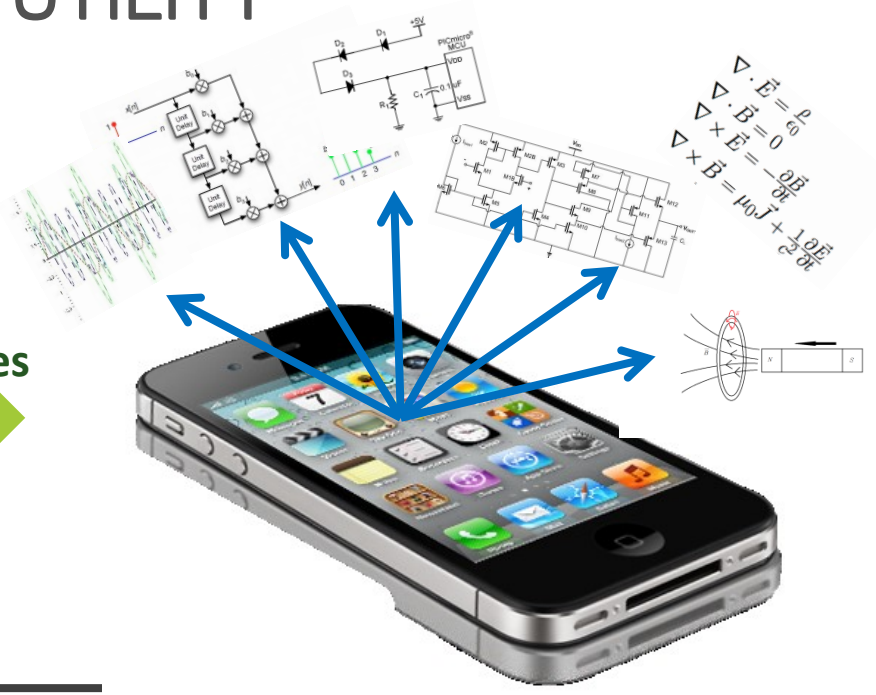
IMPORTANCE OF PERCEIVED VALUE AND UTILITY



connect the "dots" with real-world examples

Knowledge Integration



Teaching the relevance of course content can help students develop into engaged, motivated and self-regulated learners.

– research from American Psychological Association

EXPECTANCY VALUE THEORY:

We behave in a certain way because we are motivated to select a specific behavior over other behaviors due to the perceived **value** and **utility** in doing so.

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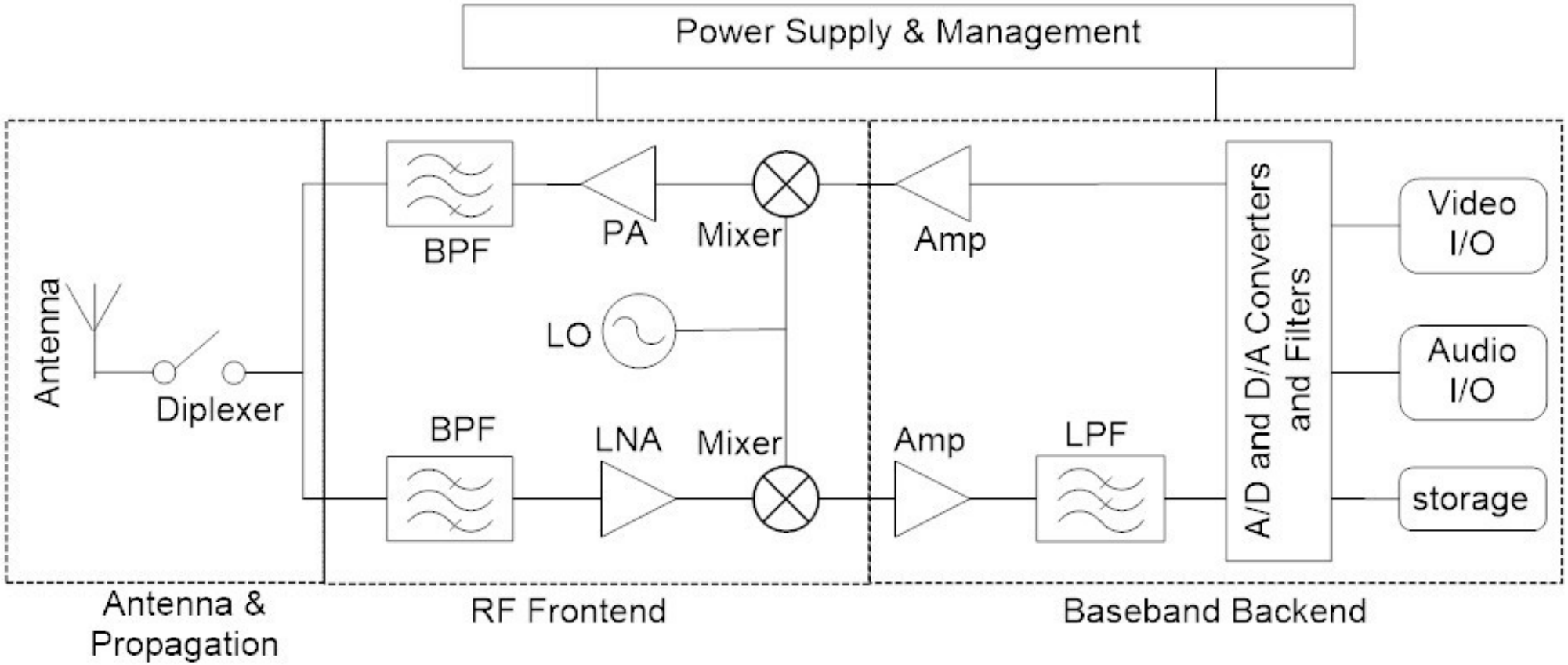
A CELL-PHONE RADIO SYSTEM AS A KI PLATFORM



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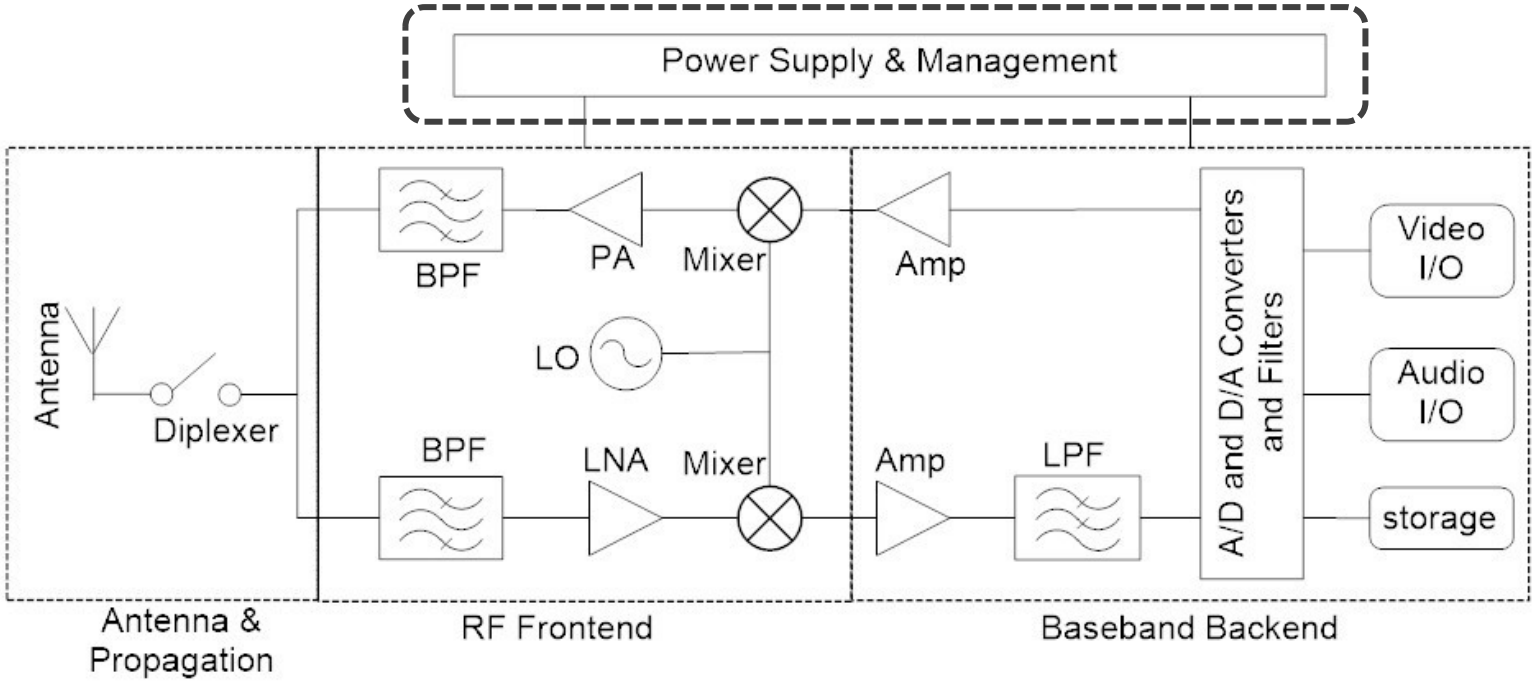

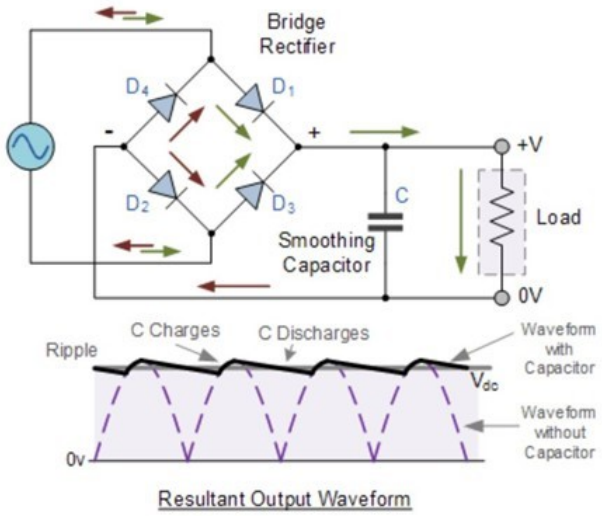

- Diodes for rectification (331)
- Electrostatic field in capacitor (341)
- Capacitor for filtering (331/311)
- Linear and non-linear circuits (311)
- Time invariant circuit (311)
- Impulse and step response of the RC circuit in determining its linearity and time invariance (311)
- The concept of periodic signals (311)
- The concept of energy and power associated with signals (341)
- Dielectric breakdown as function of dielectric material (341)

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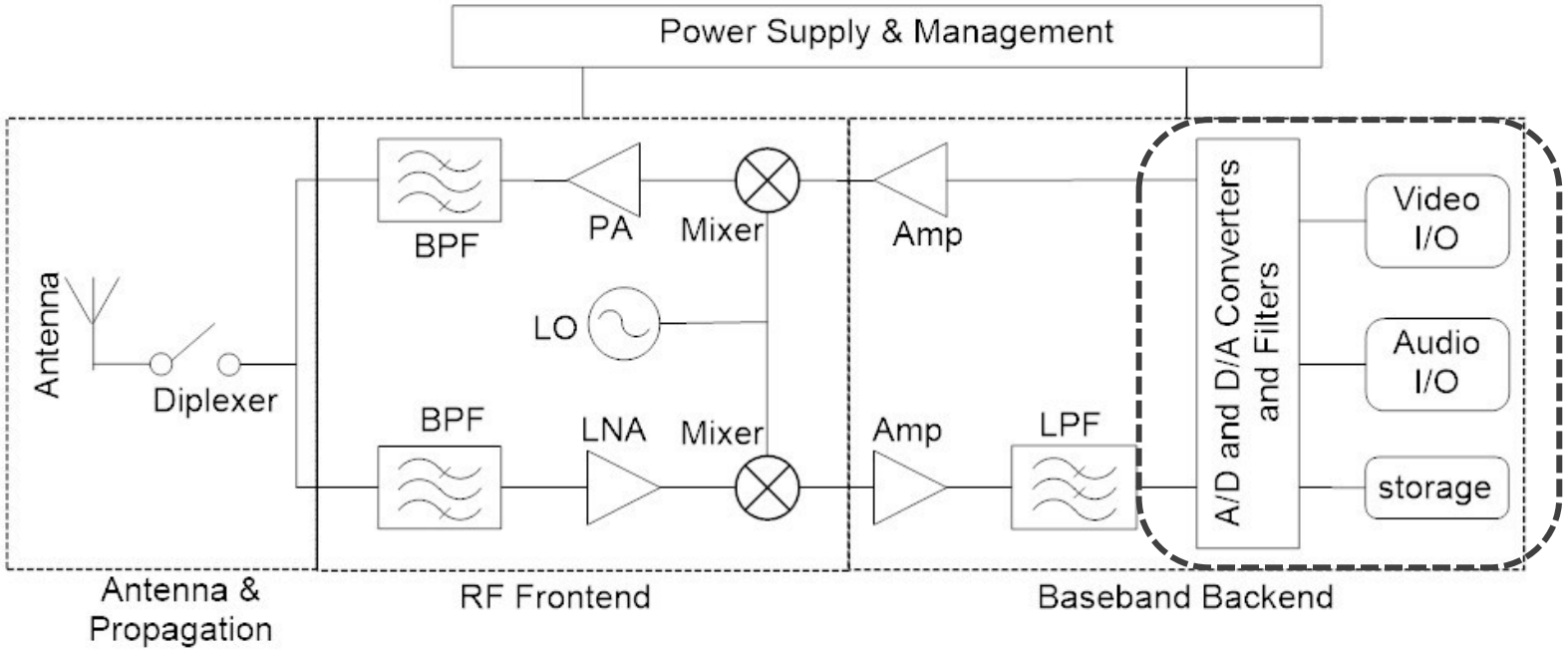

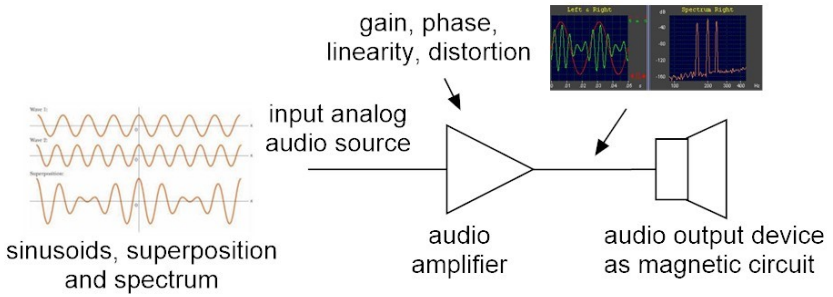

- Superposition of signals (311)
- Spectrum analysis (311)
- Transistors (331)
- Amplifiers (331)
- Large signal vs. small signal operations (331)
- Joul's law using amplifier's load resistor (341)
- Magnetic circuits (speakers) and impedance matching (341)

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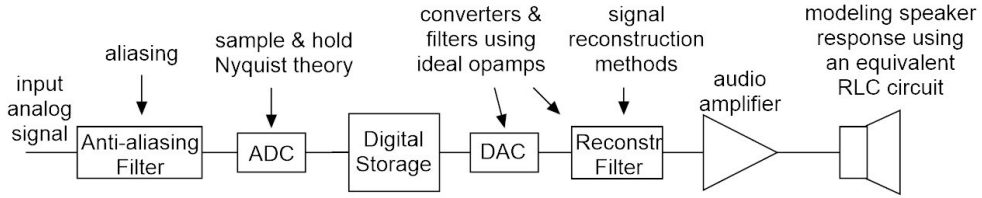

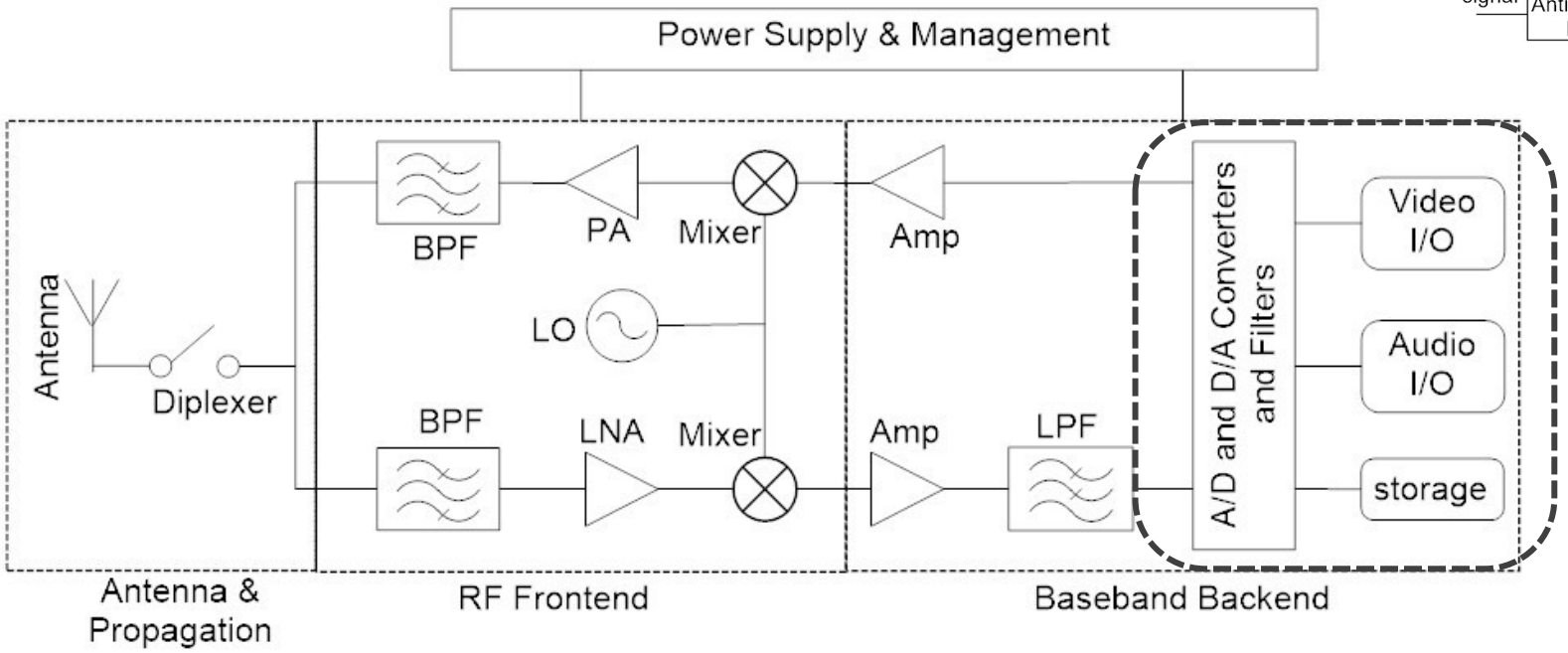

- Sampling of continuous time signals (311)
- Nyquist sampling (311)
- Aliasing and anti-aliasing (311)
- Ideal Opamps as comparators for flash ADCs & DACs (331)
- Basic operation of storage devices (331)
- Signal reconstruction methods (non-opamp and opamp based approaches) (311)
- Analysis and demonstration of magnetic circuits inside a speaker (341)

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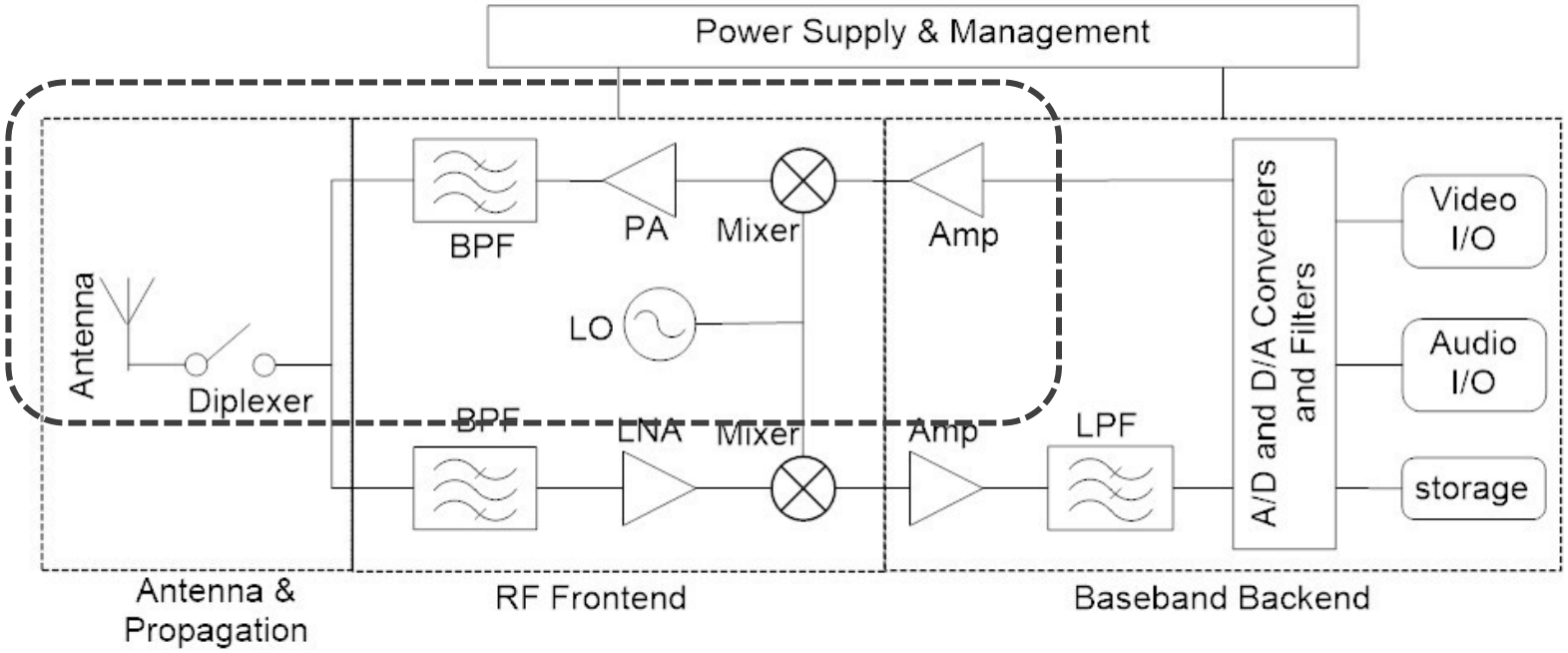

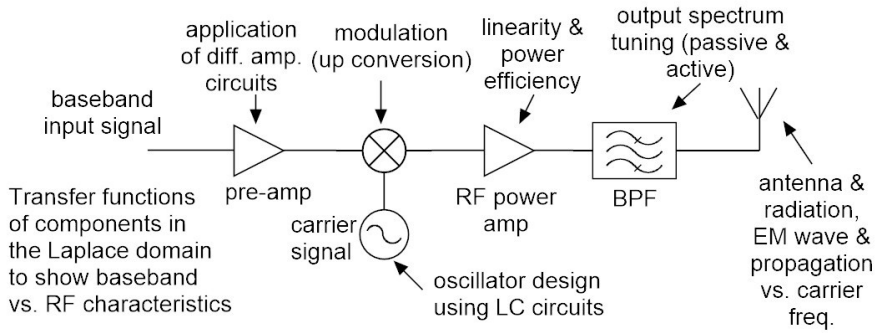

- Differential OTAs as pre-amp (332)
- Darrier frequency in radio systems (312
- Modulation techniques (up conversion) (312)
- Oscillator design using LC tank (332)
- CMOS drivers for power amplifiers in radio transmission path (332)
- Band-pass filters (BPF) and their transfer function in the Laplacian domain (312)
- Passive vs. active BPFs (332/312)
- RF power amplifiers and its efficiency illustrated as a CMOS driver plus a BPF (332/342)
- Antennas and radiation in radio systems (342)
- Transmission loss related to carrier frequency (342)
- Antenna size as a function of carrier frequency (342)

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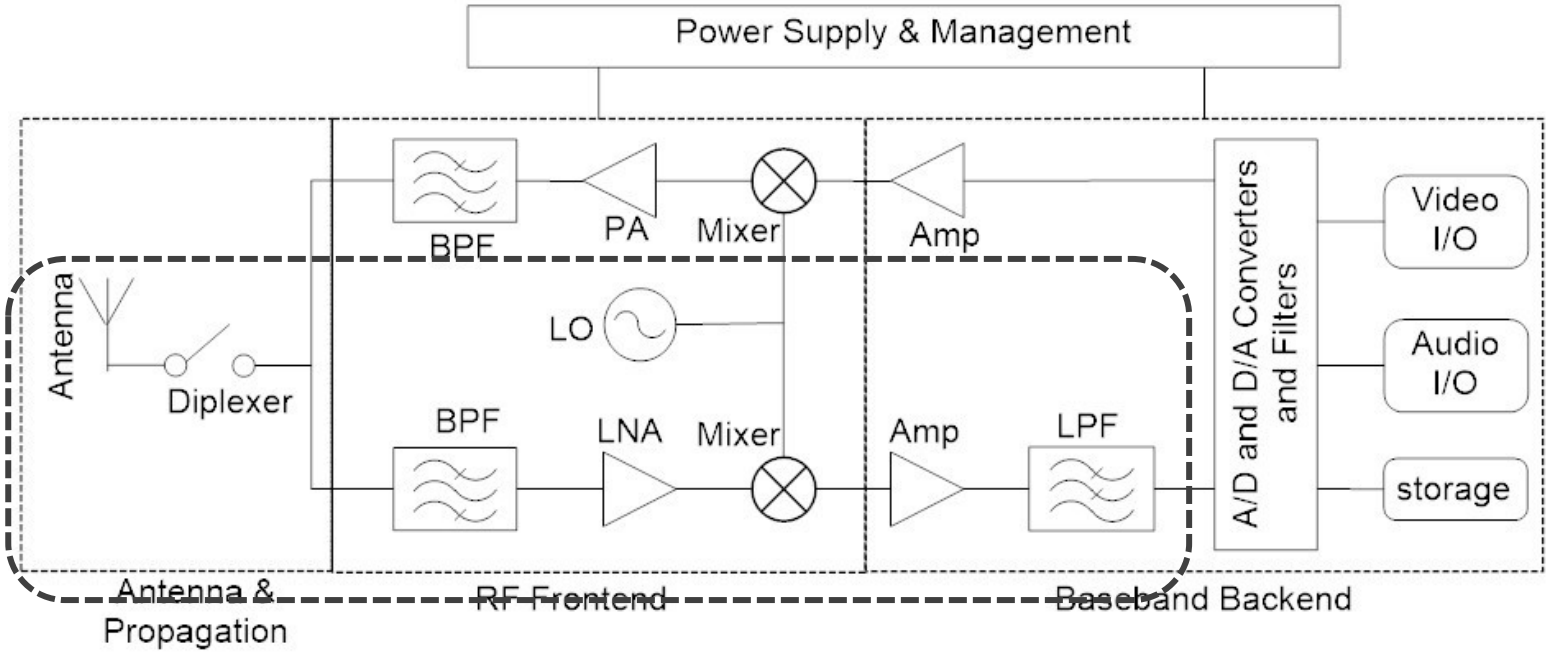

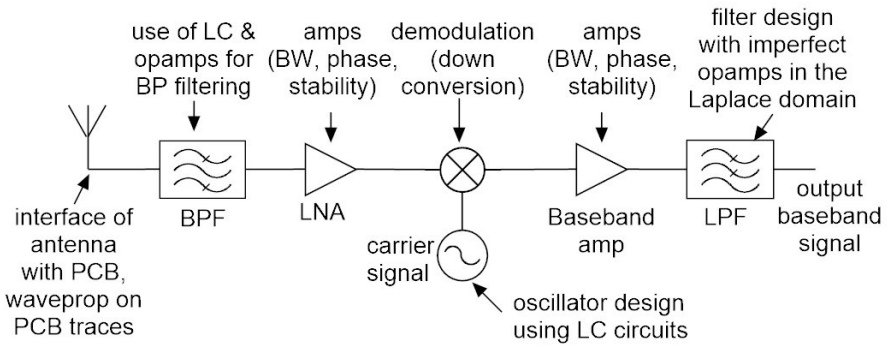

- Roles of the front-end BPF in radio receiving path (selectivity, signal blocking) (312)
- BPF with LC ladders (312/332)
- Frequency characteristics of amplifiers (312/332)
- Modulation techniques (down conversion) (312)
- Feedback topologies in frequency synthesizers (332)
- Design of baseband LPF with RC circuits and imperfect amplifiers (312/332)
- Design and characterization of interface between antenna and circuits (matching, reflection, and transmission line modeling) (342)
- Roles of discrete time signal processing (Z-transform) on future software-defined radio (312)

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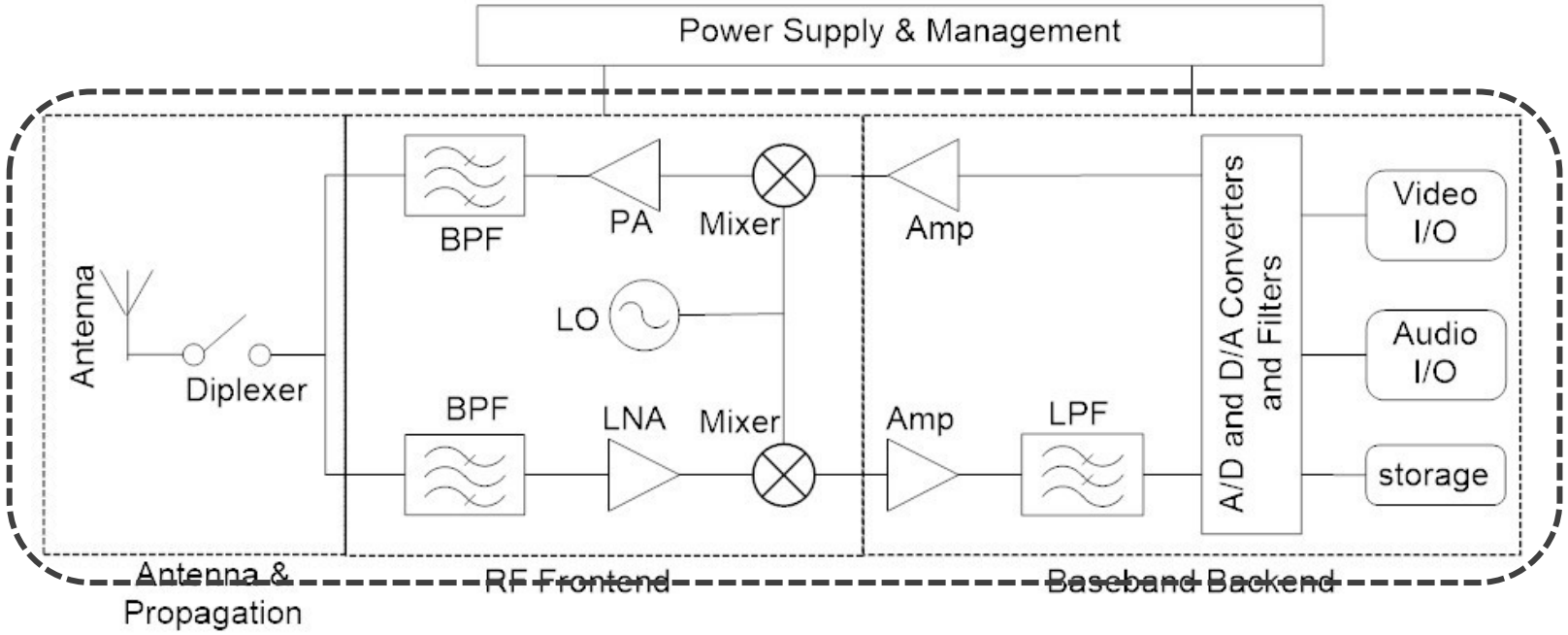
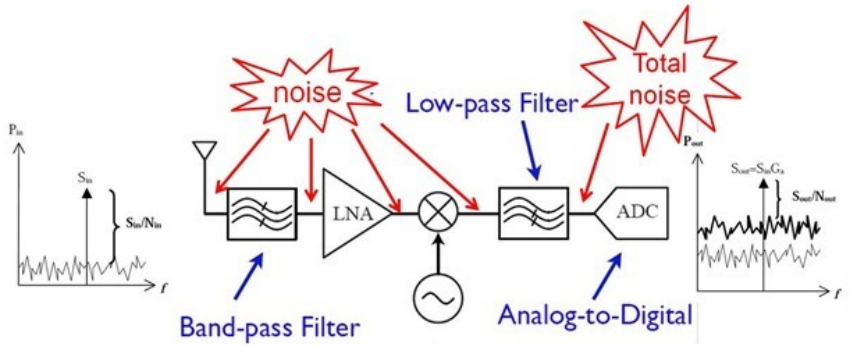
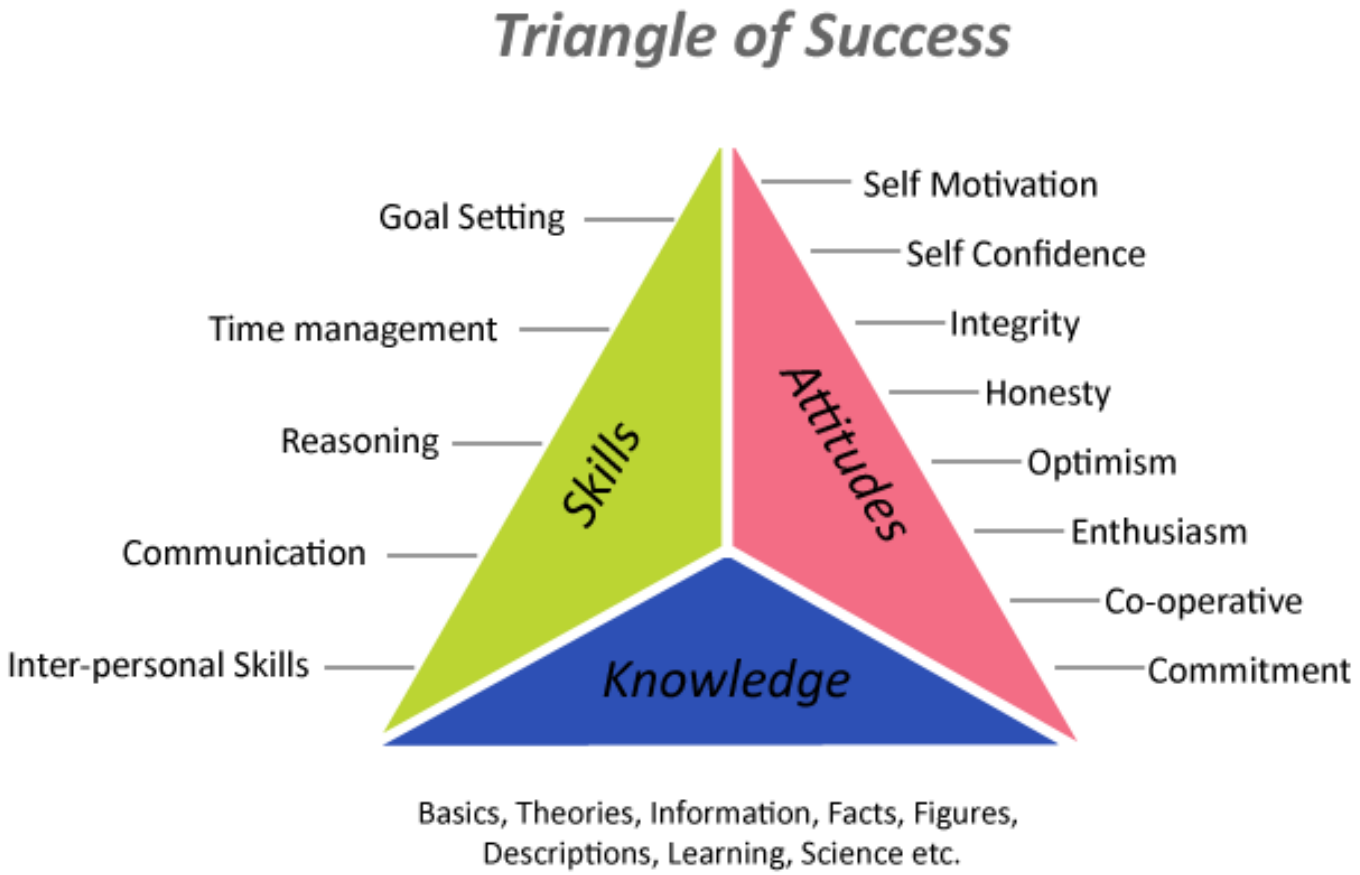




- Sources and types of noise in radio systems (332)
- How to measure noise and SNR in radio systems (332)
- How do radio systems deal with noise (332)
- Design tradeoffs in radio system design related to noise and SNR (312/332)
- A peek into a modern cell phone – How the whole system works and what 311/312/331/332/341/342 have to do with it.

TRIANGLE OF SUCCESS AND KNOWLEDGE INTEGRATION



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