

# System Design Process

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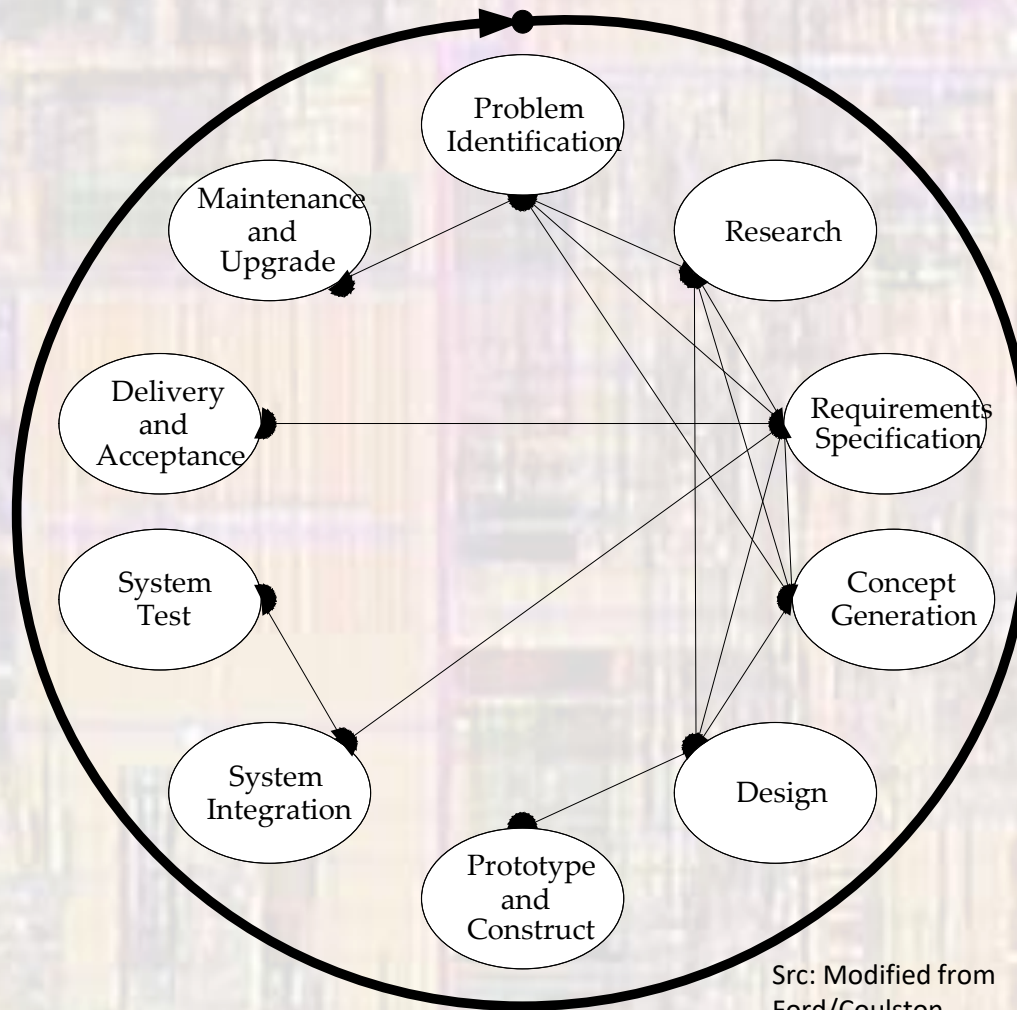
# Design Process

These slides outline the generalized design process used in most system designs. A system can range from a simple circuit to an entire mobile communications system

Upon completion: You should be able to describe each step of the generalized design process

# Design Process

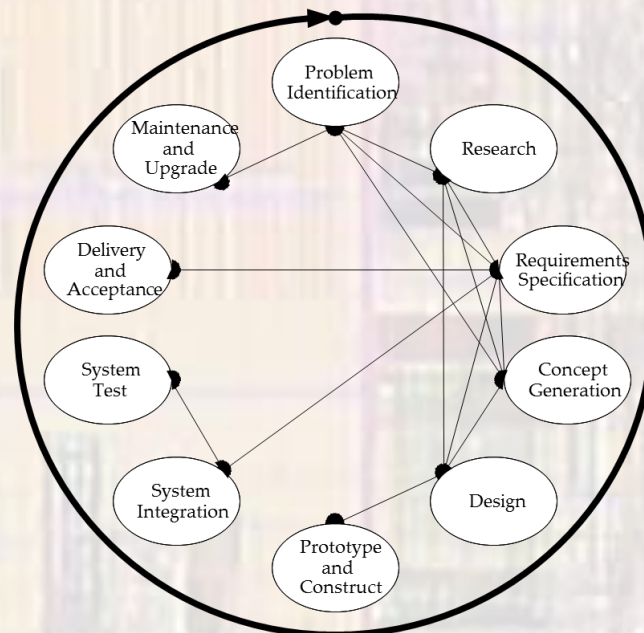
- Generalized Design Process



Src: Modified from  
Ford/Coulston

# Design Process

- Generalized Design Process
  - Each element informs and feeds back to every other element
  - Must constantly ask: “how does the decision I am about to make impact my prior assumptions and future decisions”.



Src: Modified from  
Ford/Coulston

# Design Process

- Problem Identification
  - In most cases you will be given the problem to solve
  - It is critical to test this problem identification
    - Do you understand the problem
    - Is it the fundamental problem or an already half solved problem
    - Is it well defined, but not over defined

# Design Process

- Research
  - Understand the underlying principles of the problem
  - Review current solutions
    - Look for gaps and opportunities to innovate
  - Become a subject matter expert

# Design Process

- Requirements Specification
  - Identify what the system must do to solve the problem
    - Over specify:
      - Higher cost
      - Longer development time
    - Under specify
      - Don't solve problem
      - Customer does not accept the solution
  - No design solutions should be assumed at this stage
    - Maximize the design space

# Design Process

- Concept Generation
  - Multiple design solutions are conceived
    - Initially these can be wildly creative
  - Each design solution is explored far enough to allow it to be compared to:
    - Requirements
    - Other possible design solutions
  - Typically only one design solution emerges from this phase



# Design Process

- Design
  - Hierarchical system design
  - Up/Down sub-system design
  - Detailed block, module, circuit, and software design
  - Heavy reliance on models and simulation tools
  - Tight feedback with prototyping phase

# Design Process

- Prototyping and Construction
  - Used to inform the design process
  - Prototype small elements of the design in very tight loops
  - Prototype larger elements of the design at critical development points
  - For long lead time elements (e.g. Integrated Circuits) it is critical to make the right decisions on prototyping
    - More design time → less time to correct errors found in prototyping
    - Early prototyping → more errors → higher chance of errors in the fixes

# Design Process

- System Integration
  - Pull everything together
    - Happens at multiple levels of the design hierarchy
  - Highlights specification errors (between sub-systems)
  - Highlights communications errors (between teams)

# Design Process

- System Test
  - Test everything together
    - Happens at multiple levels of the design hierarchy
  - Validates the system to the original Requirements Specifications
    - does it solve the original problem

# Design Process

- Delivery and Acceptance
  - In situ testing
    - Validate the solution
    - Uncover unexpected interdependencies
    - Frequently require “tweaks” to the solution or the system

# Design Process

- Manufacturing
  - Determine manufacturability
    - Component robustness
    - Overall system yield
    - Complexity