Communications and Design Theory:

**DESIGN:**

There are **four** **phases** of design. They are:

**Defining the Problem –** This is the phase in which you define the problem and state constraints, requirements, and where you create your team structure.

**Formulating Solutions –** This is the phase in which you begin to design possible solutions to the problem. This is also the phase in which you choose a final design, sketch it, and describe each portion.

**Developing Models and Prototypes –** This is the phase in which you make models, or prototypes. Prototypes are there to provide function, where as models are physical representations. This is where you test out the design: if the design doesn’t work, go back and try to come up with another design.

**Presenting and Implementing you design –** This is the phase where you demonstrate it to the stakeholders. Also you create a presentation to describe the design, and the project. This is also the phase in which you write a final report for the project and any lessons learned.

**COMMUNICATIONS:**

**Biomimicry**: The science of **mimicking** **nature** in order to be **more** **efficient** in both energy use and function. It is an **abstraction** from nature into a manufactured/synthetic form.Nature has had millions of years to perfect itself, even if it isn’t perfect it is still better than what we have.

There are three types of abstraction:

**Visual** – Basing a design mainly on the physical characteristics

**Functional –** Basing a design on functional characteristics

**Process –** Designing a system that is more general and doesn’t have the constraints it might have had originally.

Examples of Biomimicry:

* The **Tubercles** **on** **Whale** **Fins** allow for faster water flow and are being prototyped on plane wings and fans in order to allow for **less** **resistance** and the ability to make **sharper** **turns**.
* **Flex** **Prosthetic** **foot** based on the foot of a cheetah.
* **Reusable** **Dry** **Adhesive** **tapes** based on the way a **gecko’s** **foot** sticks to surfaces.
* **Barb Wire** based on thorns
* **Velcro** was based on **seeds** and **burrs**.
* **Reducing** **materials** based on how **bones** **hollow** where strength is less needed.
* **Self Cleaning paint** based on the surface of a **lotus**
* **Glue** based on the protein that **mussels** bond themselves to rocks with.
* **Needles** based on a **mosquito’s proboscis.**
* **Spider silk** as a form of material due to its strength.

**Concept** **Generation** – This is the process of **coming** **up** **with** **a concept** that addresses a problem. A **concept** is **an** **idea** that **provides** **a solution** to a problem specification.

There are 8 techniques when generating a conceptual Idea:

* **Confront the problem –** Is it actually a problem, and why so?
* **Change the source of the problem –** Can the problem be changed?
* **Isolate the Problem –** Can the problem be isolated to a particular part?
* **Invert the problem –** Can the source of the problem be switched with another part?
* **Reverse the problem –** Can the problem be a solution?
* **Designing by Analogy –** Can the problem be expressed in a different situation that is easier to work with?
* **Designing with Product attributes –** Can the attributes be used to effectively?
* **Consider other physical solutions –** Is there another function that provides the same result?

**Sustainable Engineering –** This is a form of engineering that is devoted to making the most efficient and self-sustaining designs.

There are 9 principles:

* **Engineer processes and products holistically –** Make sure products are functionally related.
* **Conserve and improve natural ecosystems –** Reduce as much impact on natural habitats
* **Use life-cycle thinking in all engineering concepts –** Think about what impacts it might have
* **Ensure all energy and material inputs and outputs are as benign as possible. –** Avoid toxicity.
* **Minimize depletion of natural resources –** Try to ensure reusability
* **Strive to prevent waste –** Try to minimize the amount of waste from products.
* **Engineer solutions while maintaining awareness of local cultures/environments –** be culturally respectful, and pay attention to geographical attributes
* **Actively engage communities in development of engineering ideas –** Make it beneficial for the communities involved.
* **Improve, innovate, and invent technologies –** Keep advancing to produce better products.

**Industrial Design –** Design that is based around the combination of aesthetics and functionality in order to make it more marketable.

**Past Trends (13):**

* **High** **Tech** **Style** – Functional components built into design
* **Organics** – Holistic Design – Relationship between parts
* **Pop** **Style** – Built-In Obsolescence
* **International** – Functionalist Design
* **De** **Stijl** – Primary Colours, Horizontal, Vertical
* **Streamlining** – Same stuff, different looks
* **Art Deco** – Cultural Decoration
* **Bauhaus** - Minimalistic
* **Constructivism** - Utilitarian
* **Deutsche** **Werkbund** – Art and Mass Production
* **Jugendstil** – Simpler Less Commercial
* **Art** **Nouveau** – Complex Design around couture
* **Arts and Crafts –** Qualitymoreproductively

**Current Trends (8):**

* **Design for a cause –** Form with function
* **Simplexity –** Accessible with lots of functions
* **Personalization –** Personal components
* **Globalization –** Outsourcing
* **Shrink it and Pink it –** Feminizing
* **Mass Imperfection –** Built-in Imperfections
* **Craft –** One offs
* **Focus on the Other 90% -** Design for third world

**Project Management –** Effective strategy for managing a project with focus on **Constraints**, **Cost**, **Quality**, **Time**, **Resources**.

A project is said to have activities that are:

* **In a sequence –** There is an order that completion must be done in
* **Unique –** There is something that the project has to offer
* **Complex –** There are multiple levels of depth that are be addressed
* **Connected –** Each component of the project is connected to each other.
* **Towards a Single Goal –** There is a goal that the project is targeting
* **Formed around a deadline –** There is a timeline which must be adhered
* **Dependent on Limited Resources –** There are resource constraints in place
* **Required to be completed in accordance with specification –** There are particular specifications and requirements that must be met.

**Design Safety –**

**When figuring out the Risk Priority use:**

**RPN = Severity x Occurrence x Detection**

**Hard Failures** are failures that are major and sudden

**Soft Failures** are failures due to degradation over time.

**FTA – TOP DOWN – deduced – start with problem then figure out what could be cause by breaking down**

**FMEA – BOTTOM UP – induced – start with components and figure out why they might fail or have failed**

**Intellectual Property –** There are five kinds of intellectual properties:

**Trademarks** – A word, symbol, logo, image, or phrase that is there to distinguish a product from its competition and to identify it to its manufacturer. They may be **Registered** or **unregistered.** Examples **–** BMW logo

**Domain** **Names** – Can function like trade marks in that they are used to distinguish between different companies. Must be registered with InterNIC. Examples – Google.com

**Copyrights** – These are protections granted to an original work that protect them from being imitated or sold without the original creator’s permission. They last for 50 years after the death of the owner. These do not need to be registered. Examples – Novels, Sculptures

**Trade Secrets** – These are secrets that are owned by a company and are protected so long as they remain secret. They cannot be patented due to the fact that they aren’t disclosed to the public. Examples – Coca Cola Recipe

**Patents** – Protection granted to a particular function so long as it is disclosed to the public. Last for 20 years. It must be registered with the patent office, and it must been completely detailed as to how the function works. Examples – Windshield wipers

**Industrial** **Design** – Similar to a patent, but instead of function, it is a protection of design and aesthetics. In the US they are known as design patents. Last for 10 years. Example – IPods

**Engineering Success:**

Engineering success can be said to be attributed to:

**Business** **Case** – There is a strong reason why this project should continue – Financial stability and strong rewards for successful completion

**Critical** **Success** **Factors** – Projects should have the factors that are required for the success, and they should be optimized. These should be goals strived to be completed.

**Planning** – The better planned the project the higher the chance of success.

**Team** **motivation** – If the team is motivated they will be psychologically better prepared and will want to do their best. Apathy will always lead to failure.

**Say** **No** – Don’t promise that which you cannot deliver or know better against. This will stop problems from arising.

**Maintain** **Scope** – Remaining in your boundaries will lead to success as you wont be dabbling in areas you shouldn’t and this will stop problems from unnecessarily arising.

**Risk** **Management** – Make sure you amply analyze possible risks and problems that could occur, also make sure that when problems arise you are quick to solve them so that they do not fester.

**Project** **Closure** – Make sure that when the project is complete that it is closed. An open project uses up resources and capital which is unnecessary.