Machine Design

Machine & Machin Element

Machine - perform useful work when some form of energy is applied

Machine element - smallest component of machine

Machine Design

Combination of scientific principle
technical information
imagination
↓ to perform
maximum economy and efficiancy

Need for Design

→ safe, more efficient & Comfortable
↓
safe design

→ friction blw people & product
↓
design fail
↓
need for design arises

Basic Procedure of Machine Design

Market survey

↓

Define product specification

↓

Selection of Mechanism

↓

Prepare general layout

↓

Design individual component

↓

Preparation of prototype

Machine Elements

⇒ Elementary Component of machine

(gears, shaft, clutch)

↳ General purpose machine element

↳ Special " " "

BASIC REQUIREMENTS OF MACHINE ELEMENTS

- Strength
- Rigidity
- Wear Resistance
- Minimum Dimensions and Weight
- Manufacturability
- Safety
- Conformance of Standards
- Reliability
- Maintainability
- Minimum Life Cycle Cost

Design of machine elements

- → Specification of function
- → Selection of material
- → Determination of Dimensions
- → Determination of force
- → Failure Criterion
- → Design Modification
- → Working Drawing

Traditional Design Methods

1. Design by Craft evolution
2. Design by drawing

Design Synthesis

Process of selecting
- → Configuration
- → materials
- → Shapes
- → dimension of product

Main objective is optimization

Ergonomics → relationship between man & machine
- work
- natural laws

→ to solve problems b/w man & machine using
- → anatomical
- → physiological
- → psycological principles

Aesthetic Consideration

→ customer attracted towards appealing product

→ external appearance dominates sale in market

Hooke's Law, elastic & plastic behaviour

elastic behaviour - material return backs to its original size after removal of force

Plastic behaviour - deformation remains after removal force

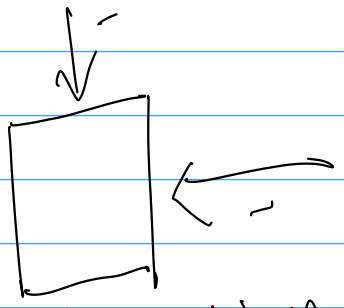
Hooke's law

$$F = k \Delta x$$

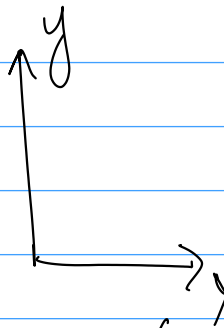
- F → Force
- k → Spring Constant
- Δx → Streched length - original length

σ_x σ_y → Normal stress

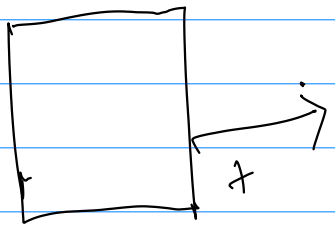
τ_{xy} → Shear stress



Compression



Reference Co-ordinate



Tension