A LECTURE NOTE
ON
TH.2 DESIGN OF MACHINE ELEMENTS
SEMESTER -5

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Sr. Lecture Mechanical Engineering

Mechanical Engineering

GOVT. POLYTECHNIC, MALKANGIRI

Design of Machine Elements

→ It is a subject which deals with the study of existing ideas, a new idea has to be conceived, the idea is then studied keeping in mind its commercial success and given shape & form in the form of drawing.

→ It is the branch of engineering which deals with the study of design, numerical & analysis, plan of m/c elements

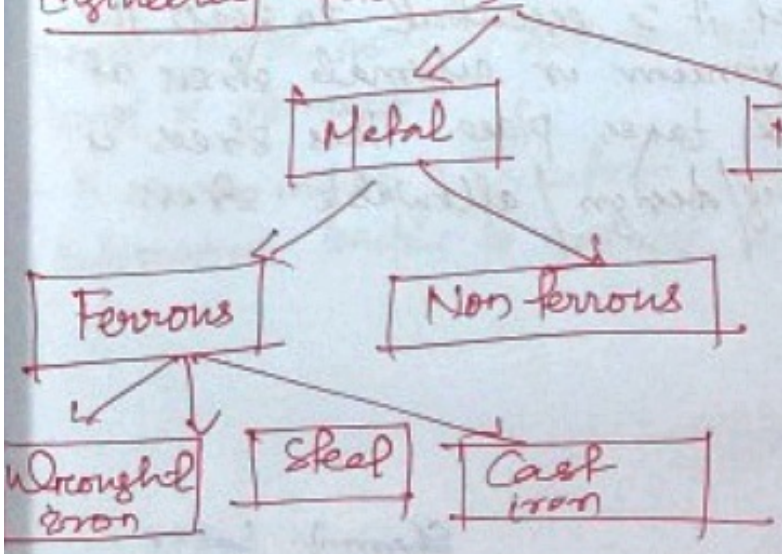
Classification of m/c Design :—

(i) Adaptive Design :- In this case the designers work is concern with adaption of existing design.

(ii) Developmental Design :- In this case types of design needs considerable scientific training and design ability in order to modify the existing design it to a new idea by adapting a new material or different method of manufacture.

(iii) New Design :- In this case needs a lot of research, technical ability, creative thinking.

Engineering Materials



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Mechanical Properties

Strength
Stiffness
Elasticity
Plasticity
Ductility
Brittleness
Malleability
Toughness
Hardness
Resilience
Creep
Fatigue
Machinability

Physical Properties

Includes luster, color, size & shape, density, elastic & thermal conductivity & melting point.

Working stress

While designing a m/c part it is essential to keep the stress lower than the maximum or ultimate stress at which failure of material takes place. This stress is known as safe / working / design / allowable stress

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Yield stress :- It is the stress at which material begins to deform plastically.

Ultimate stress :- It is the maximum stress a material can withstand without failing or breaking.

Factor of safety (FOS).

It is the ratio of maximum stress to the working stress.

Mathematically $FOS = \frac{\text{Maximum stress}}{\text{Working stress}}$.

* for Ductile material.

$$FOS = \frac{\text{Yield pt stress}}{\text{Working stress}}$$

* for brittle material

$$FOS = \frac{\text{Ultimate stress}}{\text{Working stress}}$$

Failure by Elastic deflection

It is the temporary deformation of a material or structure under load, which returns to its original shape when load is removed.

- It occures when a structure undergo excessive elastic deformation, leading to collapse or loss of functionality.

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Failure by general yielding

A mechanical component made of ductile material losses its engineering usefulness due to large amount of plastic deformation after the yield pt. stress is reached. Considerable portion of the component is subjected to plastic deformation, called general yielding.

Failure by fracture

Components made of brittle material ceases to function satisfactorily because of the sudden fracture without any plastic deformation.

Factor Governing Design of m/c Element

1) Types of load/stress
2) Kenematics of m/c
3) Selection of materials
4) Form & size of parts
5) Frictional Resistance
6) Convenient & Economical features
7) Use of standard parts
8) Safety of Operation
9) Workshop facilities.
10) No of m/c to manufacture
11) Cost of construction
12) Assembling

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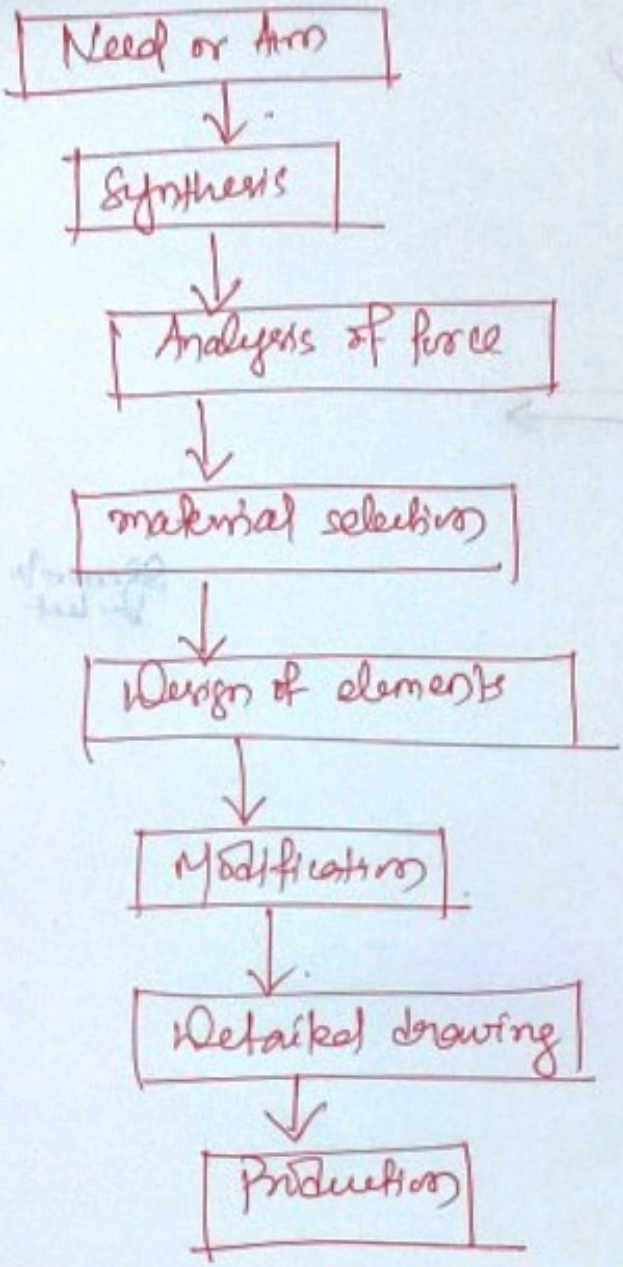
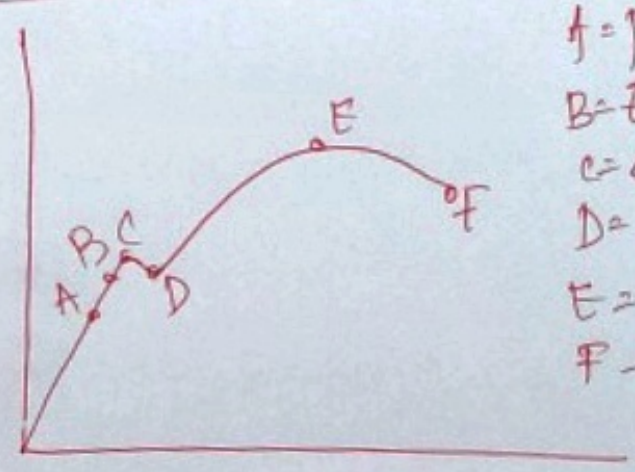
General procedure in m/c Design



Stress-strain diagram for MS



A = proportionality limit
B = Elastic limit
C = Upper yield pt
D = Lower yield pt
E = Ultimate stress
F = Fracture point

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Stress - Strain Diagram of Ductile material