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SUBJECT: DESIGN OF MACHINE ELEMENTS

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INTRODUCTION TO MACHINE DESIGN.

WHAT IS MACHINE?

- Machine is defined as a combination of resisting bodies with successfully constrained relative motions which is used transform other forms of energy into mechanical energy or transmit and modify available energy to do some useful work.
- An apparatus using mechanical power and having several parts, each with a definite function and together performing a particular task.
- Semi or fully automated device that magnifies human physical and/or mental capabilities in performing one or more operations.

What is design?

- Design is to formulate a plan satisfy a particular need and to create something with physical reality. Realization of a concept or idea into a configuration.
- Design is the creation of a plan or convention for the construction of an object, system or measurable human interaction.

What is Machine Design?

- Machine is a combination of several machine elements arranged to work together as a whole to accomplish specific purpose.
- Machine Design involves designing the elements and arranging them optimally to obtain some useful work.

Machine design is the process of engineering design. A machine is made up of mechanisms that work together to satisfy the requirements of what the machine needs to accomplish.

Classification of Machine Design.

Types of Machine Design.

- 1) Adaptive Design: - The designer's work is concerned with adaptation of existing design. The designer only makes minor alternation or modification in the existing designs of the product.
- 2) Development Design: - This type of design needs considerable scientific training and design ability in order to modify the existing design into a new idea by adopting a new material or different method of manufacture. The designer starts from the existing design, but final product may differ quite markedly from the original product.
- 3) New Design: -This type of design needs lots of research, technical ability and creative thinking.

Types of Design based on method.

- 1)Rational Design: - Based on determining the stresses and strains of components and thereby deciding their dimensions. This type of design depends upon mathematical formulae of principal of mechanics.
- 2) Empirical Design: - This type of design depends upon empirical formulae based on the practice and past experience
- 3) Industrial Design: - This type of design depends upon the production aspects to manufacture any machine component in the industry. Based on industrial considerations and norms viz. market survey, external look, production facilities, low cost, use of existing standard products.

Factors governing in Machine Design.

- What device or mechanism to be used?
- Relative arrangement of the constituent elements.
- Material
- Forces on the elements
- Size
- Shape and space requirements
- Weight of the product
- The method of manufacturing the components and their assembly.
- How will it operate.
- Reliability and safety aspects.
- Inspectibility
- Maintenance
- Cost of the designed product

Design procedure.

Following procedures to be adopted for a particular design.

- 1 Need or Aim.
- 2 synthesis(mechanism).
- 3 Analysis of forces.
- 4 Material selection.
- 5 Design of elements.
- 6 Modification.
- 7 Detailed drawing.
- 8 Production.

Classification of Engineering Materials.

The engineering materials are mainly classified as:

Metals and their alloys, such as iron, steel, copper, aluminum, etc.

Non-metals, such as glass, rubber, plastic, etc. The metals may be further classified as:

(a) Ferrous metals.

(b) Non-ferrous metals.

The ***ferrous metals*** are those which have the iron as their main constituent, such as cast iron, wrought iron and steel.

The ***non-ferrous*** metals are those which have a metal other than iron as their main constituent, such as copper, aluminum, brass, tin, zinc, etc.