TO**PIC : DESIGN &DESIGN CONSIDERATIONS**

The term design can be defined as the formulation of a plan for the satisfaction of human need.

Design means to create something new or arrange existing things in a new order to satisfy a recognized need of society.

Product Design :

● Product design is the design of a product which is a sub-system of any mechanical system.

● Examples of the product design are : design of gearbox, design of brake, design of clutch, etc

**DESIGN CONSIDERATIONS**

● Design considerations are the characteristics which influence the design of the element or, perhaps, the entire system. Normally, a number of such characteristics have to be considered in any design problem.

● In a given design problem, the design engineer should identify the various design considerations and incorporate them in the design process in their order of importance.

● For example, in the design of a spring, two most significant design considerations are : strength and stiffness.

**The various design considerations are discussed as follows :**

1. Strength :

● The machine elements are subjected to any one or combination of loads like : forces, bending moments, and torque.

● A machine element should have sufficient strength to avoid failure either due to yielding or due to fracture, under the loads.

2. Rigidity :

 A machine element should have sufficient rigidity so that its linear as well as angular deflections, under the loading, are within the permissible limits.

3. Reliability :

● The reliability is defined as the probability that a component, system, or device will perform without failure for a specified period of time under the specified operating conditions.

● A machine element should have reasonably good reliability so that it can perform its function satisfactorily over its life span.

4. Safety :

 A machine element should be designed such that it ensures safety of the users and machine.

5. Cost :

● The life cycle cost of the machine element consists of : production cost, operating cost, maintenance cost, and disposal cost.

● A machine element should have a minimum possible life cycle cost.

6. Weight :

 A machine element should have a minimum possible weight.

7. Ergonomics :

● Ergonomics is defined as the scientific study of the man-machine-working environment relationship and the application of anatomical, physiological, and psychological principles to solve the problems arising from this relationship.

● The objective of ergonomics is to make the machine fit for user rather than to make the user adopt himself or herself to the machine. If the user in likely to communicate directly with the machine element, it should be designed with an ergonomic considerations.

8. Aesthetics :

Aesthetics deals with the appearance of the product. In a present days of buyer's market, with a number of products available in the market are having most of the parameters identical, the appearance of the product is often a major factor in attracting the customer. This is particularly true for consumer durables like : automobiles, domestic, refrigerators, television sets, music systems, etc.

9. Manufacturing :

In a design of machine element, the selection of manufacturing processes must be given a due importance. The manufacturing processes should be selected such that the machine element can be produced with minimum manufacturing cost and, as far as possible, with existing manufacturing facilities.

10. Conformance to Standards :

A design of machine element should conform to the national and / or international standards and codes.

11. Assembly :

A machine element or a product should be designed such that it facilitates to minimize the assembly cost and time.

12. Friction and Wear :

Friction and wear are major contributing factors for reducing the life of machine elements and increasing the power loss. The friction can be reduced by improving the surface finish, adequately lubricating the surfaces, and replacing the sliding motion by rolling motion. The wear can be reduced by increasing the surface hardness.

13. Life :

A machine element should be designed for an adequate life.

14. Vibrations :

A machine element should be designed so as to keep the vibrations at minimum level.

15. Thermal Considerations :

A machine element should be able to withstand the temperature to which it may be subjected. In addition, it should dissipate the heat generated, if any.

16. Lubrication :

In a design of machine elements, due consideration must be given for the lubrication of the elements, if there is relative sliding or rolling motion between the elements.

17. Maintenance :

A machine element should be such that it can be easily repaired or serviced.

18. Flexibility :

A machine element should be flexible so that the modifications can be carried out with minimum efforts.

19. Size and Shape :

As far as possible, standard sizes and shaped should be adopted for machine element.

20. Stiffness :

Whenever a stiffness is a functional requirement like in springs, a machine element should be designed with a precise value of required stiffness.

21. Corrosion :

A machine element should be a corrosion resistance. This can be achieved by a proper selection of material and adapting the surface coating.

22. Noise :A machine element should be designed such that the noise during operation is at minimum possible level.