SCRIET(AGRICULTURE DEPATMENT),CCSU MEERUT

MACHINE DESIGN(UNIT 2ND, SHAFT LECTURE 3)

Introduction

A shaft is a rotating machine element which is used to transmit power from one place to another. The power is delivered to the shaft by some tangential force i.e. twisting moment. In order to transfer the power from one shaft to another, the various members such as pulleys, gears etc. are mounted on it by means of keys or splines. We may say that a shaft is used for the transmission of torque and bending moment.

Notes:

a) The shafts are usually solid in cross-section but sometimes hollow shafts cylindrical, but may be square or cross-shaped in section.
b) Axle is a stationary though similar in shape to the shaft, is a stationary machine and transmission of bending moment only.
c) Spindle is a short shaft that imparts motion either to a cutting tool.

Material Used for Shafts

The material used for shafts should have the following properties :

1. It should have high strength (Strong).
2. It should have good machinability (easily machined).
3. It should have low notch sensitivity factor (stress concentration is less i.e. ductile material is used).
4. The material used for ordinary shafts is carbon steel of grades 40 C 8, 45 C 8, 50 C 4 and 50 C 12.

Manufacturing of Shafts

Shafts are generally manufactured by hot rolling and finished to size by cold drawing or turning and grinding. The cold rolled shafts are stronger than hot rolled shafts but with higher residual stresses. The residual stresses may cause distortion of the shaft when it is machined, especially when slots or keyways are cut.

Types of Shafts

The following two types of shafts are important from the subject point of view :

1. Transmission shafts. These shafts transmit power between the source and the machines absorbing power. The counter shafts, line shafts, overhead shafts and all factory shafts are transmission shafts. Since these shafts carry machine parts such as pulleys, gears etc., therefore they are subjected to bending in addition to twisting.

2. Machine shafts. These shafts form an integral part of the machine itself. The crank shaft is an example of machine shaft.

Stresses in Shafts

1. Shear stresses due to the torque.
2. Bending stresses
3. Due to combined torsional and bending loads.

Design of Shafts

The shafts may be designed on the basis of
1. Strength, and 2. Rigidity and stiffness.
In designing shafts on the basis of strength, the following cases may be considered :
(a) Shafts subjected to twisting moment or torque only,
(b) Shafts subjected to bending moment only,
(c) Shafts subjected to combined twisting and bending moments(i.e. a+b)
(d) Shafts subjected to axial loads in addition to combined torsional and bending loads(i.e. axial load +a+b).