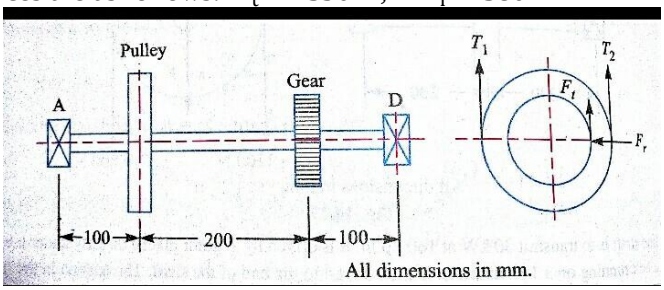
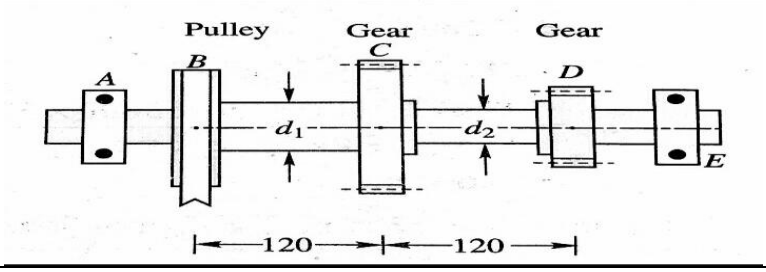
Mechanical Engineering Department

Tutorials-1— Shafts

B E Mechanical SEM IV 181902-Machine Design and Industrial Drafting Year 2016

1	A propeller shaft is required to transmit 50 kW power at 600 rpm. It is a hollow shaft, having an inside diameter 0.8 times of the outside diameter. It is made of steel (S_{yt} = 380 N/mm^2) and the factor of safety is 4. Calculate the inside and outside diameters of the shaft. Assume (S_{sy}=0.5S_{yt})
2	A standard splined connection 8×36×40 is used for a gear and shaft assembly rotating at 700 rpm. The dimensions of the splines are as follows: Major diameter = 40mm Minor diameter = 36mm Number of splines = 8 The length of the gear hub is 50 mm and the normal pressure on the splines is limited to 6.5 N/mm^2. Calculate the power that can be transmitted from the gear to the shaft.
3	A shaft made of steel receives 7.5 kW power at 1500 rpm. A pulley mounted on the shaft as shown in fig. has ratio of belt tensions 4. The gear forces are as follows: F_t = 1590 N; F_r = 580 N  Design the shaft diameter by maximum shear stress theory. The shaft material has the following properties: Ultimate tensile strength = 720 MPa; Yield strength = 380 MPa; Factor of safety = 1.5
4	Two gears and a pulley are mounted on a shaft, as shown in fig. The pulley receives a power of 24 kW and transmits 14 kW to gear C, and 10 kW to gear D. The shaft rotates at 400 rpm. Determine the shaft diameters d_1 and d_2. The allowable shear stress in shaft is not to exceed the σ_{yt} of the material. The shaft material is 55C8, with σ_{yt} = 460 MPa. The angular rotation between B and C, and between C and D, i.e; over 120 mm each distance of shaft is not to exceed 0.05˚. Pulleys and gears are keyed to the shaft. The SCF for key and keyways can be taken as 2.84. G = 84,000 N/mm^2 
5	A pulley is keyed to a shaft midway between two bearings. The shaft is made of cold drawn steel for which the ultimate strength is 600 N/mm^2 and the yield strength is 450 N/mm^2. The bending moment at the pulley varies from 200 N.m to 400 N.m and the torque on the shaft varies from 100 N.m to 250 N.m. Design a suitable shaft for infinite life. Assume the following additional parameters: Factor of safety = 1.5 Load correction factor (a) In bending = 1.0 (b) In torsion = 0.6 Size factor = 0.85 Surface factor = 0.9 Stress correction factor (a) In bending = 1.6 (b) In torsion = 1.3