

Instructions: Answer all FIVE questions which are of equal credits. Any data, if not furnished, may be assumed.

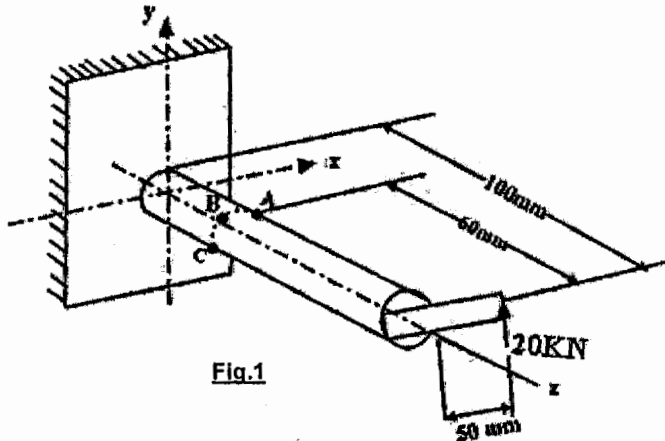


Fig.1

1. Find the factor of safety against static failure at point A, located on the top surface of the cylindrical cantilever bar of radius 50mm and loaded as shown in Fig.1. Assume a ductile material of $\sigma_{yp} = 400$ MPa. Use both maximum shear stress theory and maximum distortion energy theory to solve the problem.

2. The bar shown in the Fig.2 is machined from C 35 cold-drawn steel flat of 12mm thickness. The axial force F acting on the connecting link portion, shown in the diagram, fluctuates between a tension of 5kN and a compression of -15kN. Find the factor of safety.

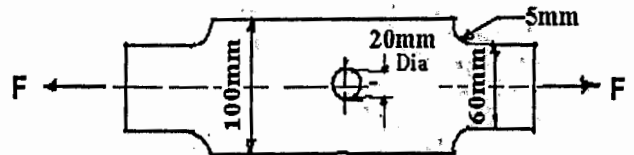


Fig.2

3. 12 bolts are used to hold the cylinder head of a reciprocating air compressor in position. The air pressure is 700 kPa and the cylinder bore diameter is 100 mm. A soft copper gasket with long bolts is used for sealing. Estimate the bolt size such that the joint does not separate. Take the tensile yield stress of the bolt material to be 500 MPa.

4. The Fig.3 shows the rod end of a typical cotter joint that supports an axial load of 28kN. The material for the rod end is steel with the allowable stresses in tension, compression and shear as 50 MPa, 60 MPa and 35 MPa respectively. Find the dimensions d , d_1 and d_2 .

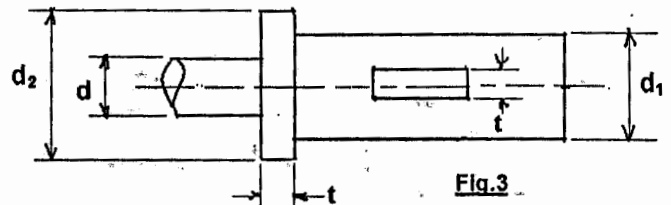


Fig.3

5. The Fig.4 shows a rotating shaft supported at A and D and is loaded by the non-rotating force F . The shaft is made of cold drawn C45 steel. Estimate the life of the shaft.

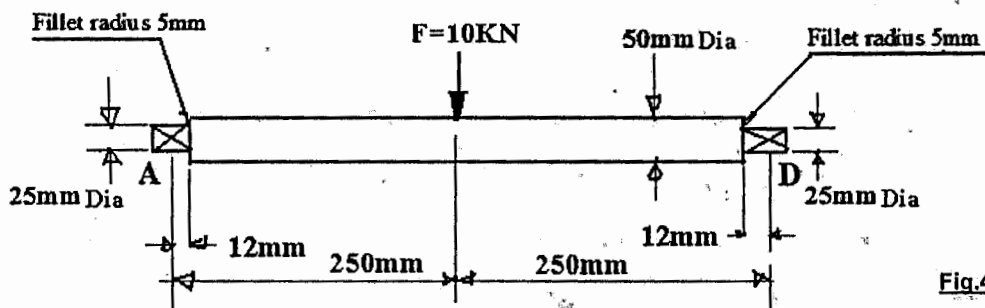
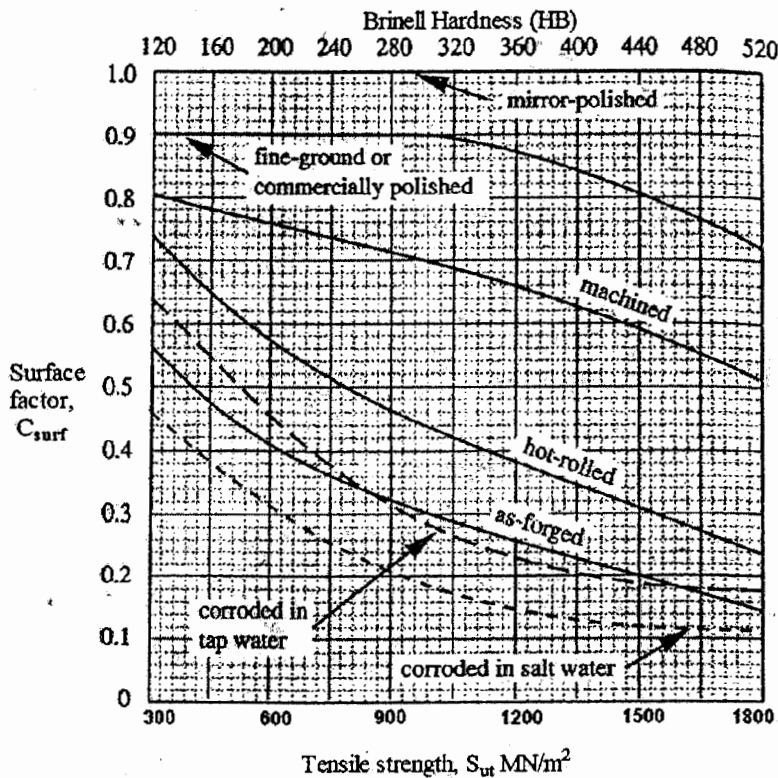
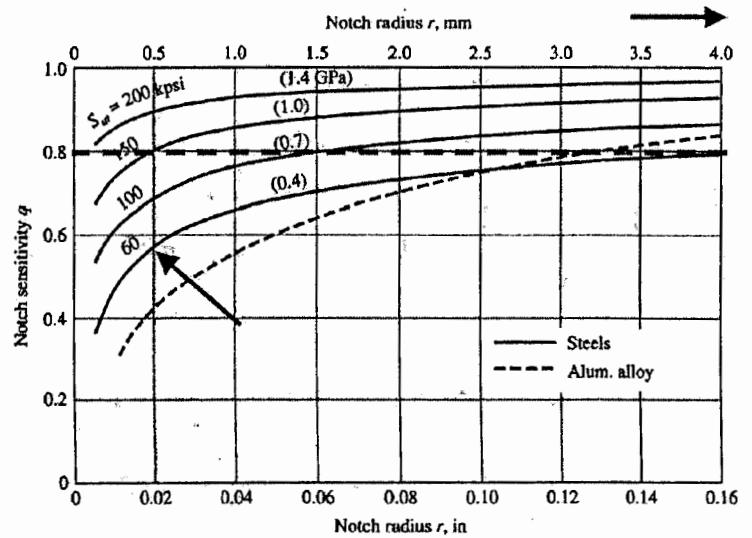
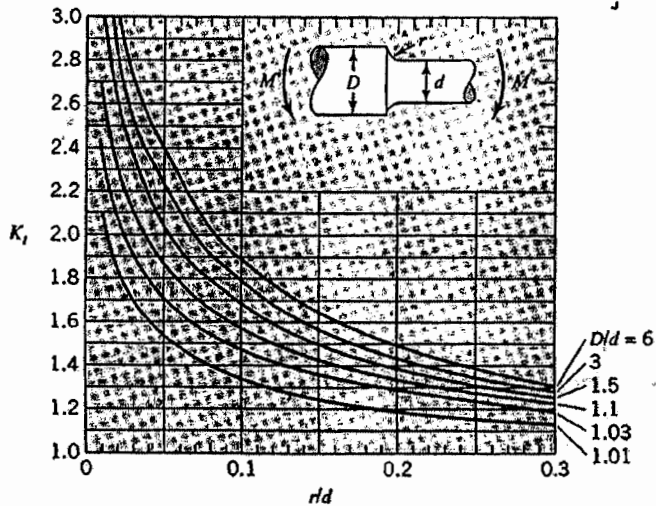
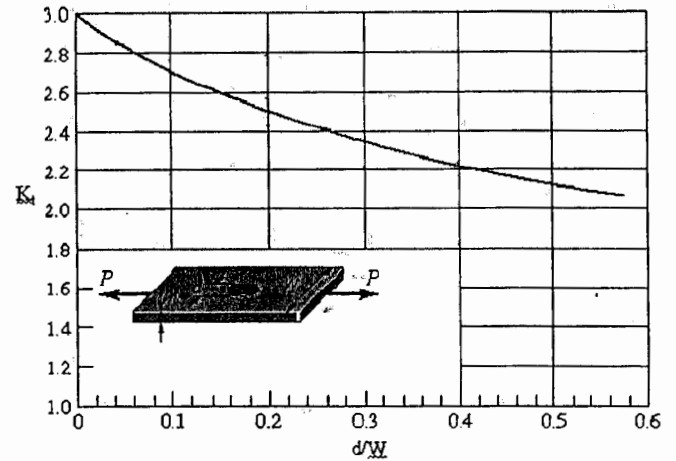
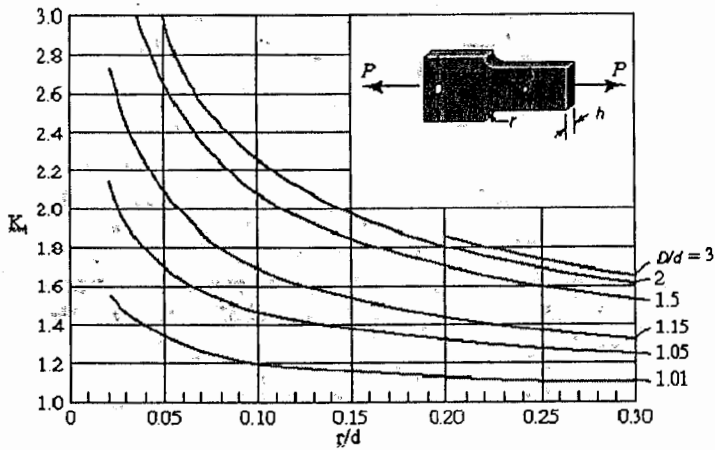


Fig.4

Useful data are on the reverse side



Properties of some carbon steel

AISI No.	UTS (MPa)	Yield Strength (MPa)	Brinell hardness
1010	HR 320	180	95
	CD 370	300	105
1015	HR 340	190	101
	CD 390	320	111
1020	HR 380	210	111
	CD 470	390	131
1030	HR 470	260	137
	CD 520	440	149
1035	HR 500	270	143
	CD 550	460	163
1040	HR 520	290	149
	CD 590	490	170
1045	HR 570	530	179
1060	HR 680	370	201
1080	HR 770	420	229