淡江大學八十八學年度碩士班招生考試試題

系別：機械工程學系　　科目：材料力學　　本試題共 二 頁

1. (20%) A 250 mm diameter pulley is mounted on a shaft midway between two supporting bearings that are 750 mm apart. The pulley is driven by a belt, both strands pulling vertically upward. If the tension in the tight side of the belt is 2.7 kN and in the slack side is 900 kN. What is the maximum bending moment and the maximum torsional moment if power is taken from one end of the shaft through a flexible coupling?

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2. (25%) A crank built up from cylindrical sections by welding required a loading of 1kN to overcome the resistance when in the position shown in Fig. 1..

(a) Compute the maximum normal and shear stresses induced in the section A-A.

(b) Determine the maximum shear stresses induced in parts I, II, and III.

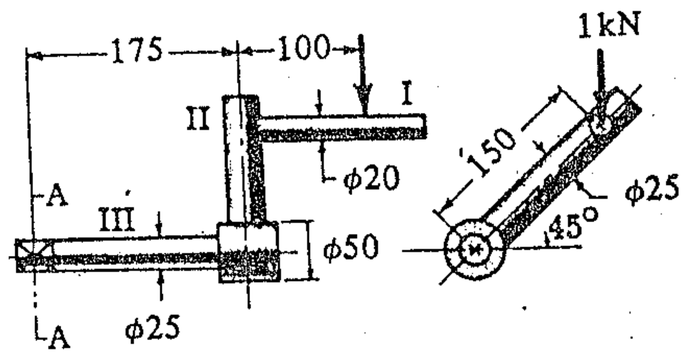

Fig. 1
(unit is in mm)

3. (25%) A coupling dimensioned as shown in Fig. 2 transmits 100 hp at 300 rpm. For all parts, yield-point stress in tension = 60,000 psi and in shear = 30,000 psi. Note: T = 63,000hp/N, where T is in lb-in, N is in rpm..

(a) Compute the factor of safety shear for bolts in the flange.

(b) Compute the factor of safety bearing for bolts in the flange.

(c) Determine the minimum safety factor for bolts in the flange.

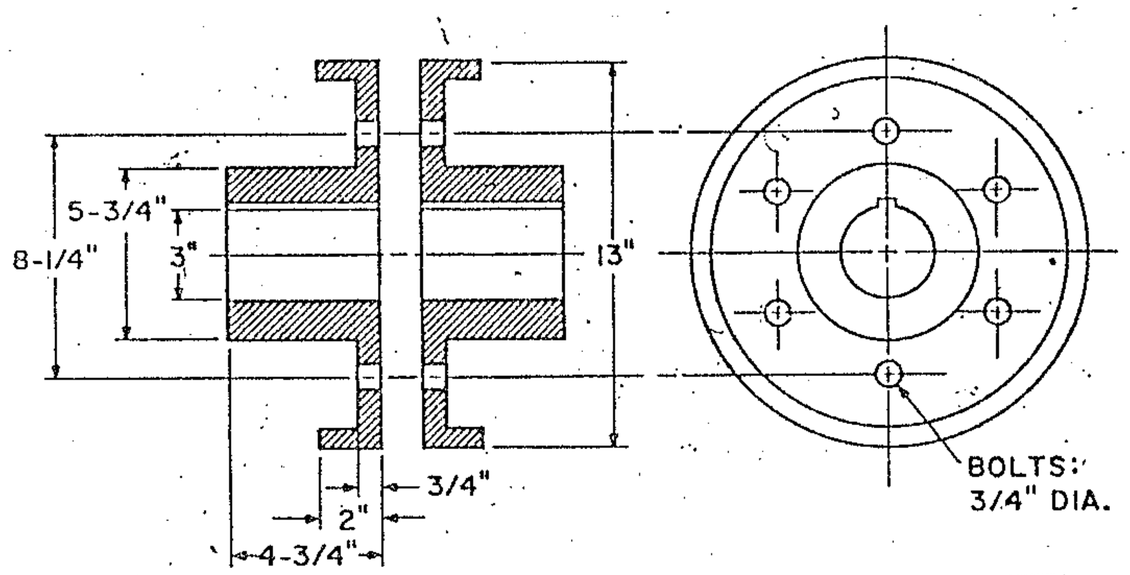

Fig. 2

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4. (30%) A thin steel disk is to be used at 14,000 rpm as a rotating blade for cutting blocks of paper. It will be of uniform thickness except where sharpened at the periphery. The outside diameter may be taken as 250 mm. The disk is mounted on a 56 mm diameter part of a shaft and clamped shown in Fig. 3. Material is AISI 1060, unquenched, with S_y= 480 Mpa and $\rho=7.778\times10^{-9}$ kg.m/mm^4. The friction of clamping is ignored.

(a) Determine the tangential stress at r = a?

(b) Determine the tangential stress and r = b?

(c) Determine the maximum radial stress at $r=\sqrt{ab}$?

(d) Determine the location and the value of the maximum shear stress?

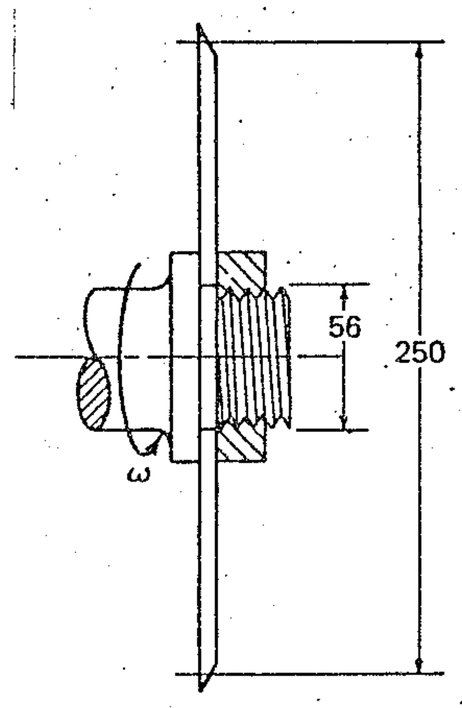
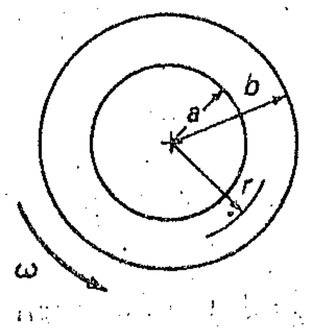


Fig. 3

TABLE 1. Cylinders of Uniform Length—Loading, Boundary Conditions, Stresses and Displacements. ρ = density, ν = Poisson's ratio, E = modulus of elasticity

(3) Thin uniform disk. Rotation ω. 	at $r=a$, $\sigma_r=0$	$\sigma_r=\rho\omega^2\frac{3+\nu}{8}\left(b^2+a^2-\frac{a^2b^2}{r^2}-r^2\right)$
		$\max\sigma_r=\rho\omega^2\frac{3+\nu}{8}(b-a)^2$ at $r=\sqrt{ab}$
	at $r=b$, $\sigma_r=0$	$\sigma_t=\rho\omega^2\frac{3+\nu}{8}\left(b^2+a^2+\frac{a^2b^2}{r^2}-\frac{1+3\nu}{3+\nu}r^2\right)$
		$\max\sigma_t=\frac{\rho\omega^2}{4}\left[(3+\nu)b^2+(1-\nu)a^2\right]$ at $r=a$
		$u=\rho\omega^2\frac{r}{E}\frac{(3+\nu)(1-\nu)}{8}\left(b^2+a^2+\frac{1+\nu}{1-\nu}\frac{a^2b^2}{r^2}-\frac{1+\nu}{3+\nu}r^2\right)$

◀注意背面尚有試題▶