

1. Define the following terminologies: (25%)
 - (a) Safety factor.
 - (b) von Mises stress.
 - (c) Endurance limit.
 - (d) Miner's rule.
 - (e) Soderberg and modified Goodman criterion.

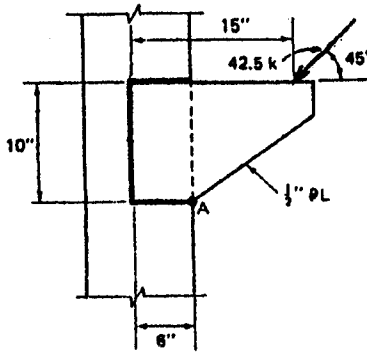
2. A ball bearing is subjected to a radial load of 770N for 2.15×10^9 revolutions.
 - (a) What value of dynamic load rating should be used to enter the bearing catalog? (7%)
 - (b) The bore diameter is 25mm. Select suitable ball bearing from the following ball bearings. (6%)

Bearing Number	*Dynamic Load Rating (C)*
6004	7200N
6005	8650N
6006	10200N
6204	9800N
6205	10800N
6206	15000N
6304	12200N

3. Design a single disk clutch to transmit 100N-m. of torque at 750 rpm using a molded lining with a maximum pressure of 1.0Mpa and the coefficient of friction $\mu=0.25$. Assume uniform wear.
 - (a) Find the outside and inside diameters (d_o and d_i) required if $d_i = 0.577d_o$. (6%)
 - (b) What is the actuating force? (6%)

(背面仍有題目,請繼續作答)

4. For a single bracket-welded to the face of a column, as shown in the figure, determine the size of the fillet welds required. Use the E70xx electrodes ($S_u=70\text{ksi}$, $S_y=57\text{ksi}$) and AISI 1018 steel ($S_u=58\text{ksi}$, $S_y=32\text{ksi}$). According to the AISC Code, the permissible stress for shear should be $<0.4S_y$, and for bending $<0.6S_y$. Weld size should be specified in the increment of $1/16"$. Calculate the final safety factor of your design based on the distortion energy theory. (30%)



5. A machine uses a pair of concentric helical compression springs to support a dynamic load of 0 to 2.25kN. Both springs are made of steel and have the same length when loaded and when unloaded. The outer spring has $D=45\text{mm}$, $d=8\text{mm}$, $N=5$; the inner spring $D=25\text{mm}$, $d=5\text{mm}$, and $N=10$. Calculate the deflection, and also the maximum stress in each spring. If the working frequency should be at least 20 times the natural frequency of the spring, what is the minimum working frequency the combined springs can be used for? (20%)