國　立　清　華　大　學　命　題　紙

八十五學年度 動力机械 系（所） 丁 組碩士班研究生入學考試

科目 机械設計 科號 2801 共 2 頁第 1 頁 *請在試卷【答案卷】內作答

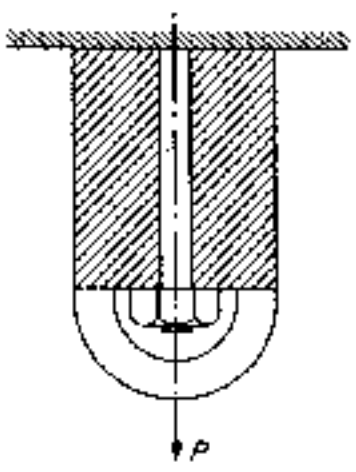
1. (a) 請繪圖並說明液動軸承 (hydrodynamic bearing) 的工作原理，亦即軸承的浮力如何產生？(b) 請舉出三種與設計液動軸承有關的參數，並說明各參數的影響爲何？ (10%)

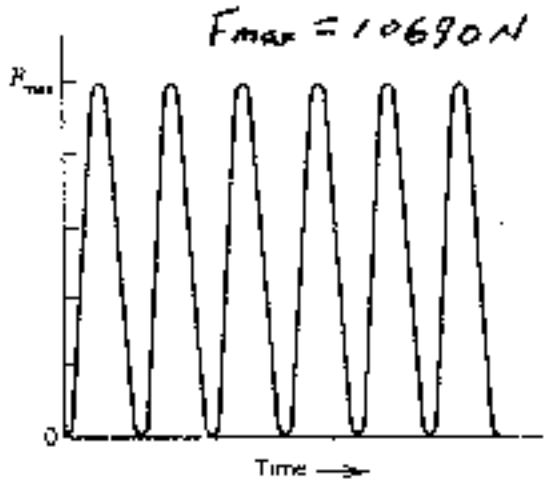
2. 若你是一位工程師，當發現一機器之螺栓斷裂時，你可能會觀察斷裂表面來判斷造成螺栓破壞的原因是由於穩定性負載(steady loading)還是變化性負載(variable loading)；請問該如何判斷？ (5%)

3. Define the following terms (10%):
   (a) self-locking of power screw,
   (b) the coefficient of speed fluctuation of flywheel.

4. (a) Derive the equation $T = \mu F(r_o + r_i)/2$, which relates torque T to axial force F for a single-surface axial disk clutch with uniform-wear assumption, where μ is the coefficient of friction, r_o and r_i are outside and inside radii, respectively. (10%)
   (b) For a given r_o and a certain allowable pressure, determine the magnitude of r_i that will result in the maximum torque. (5%)

5. Let the bolt in the following figure be M12 × 1.25, the stress area of this bolt, $A_t = 92.1$ mm^2. Bolt and member are of the same length; the threads stop immediately above the nut. The bolt material has ground threads and a yield strength of 476 MPa and ultimate strength of 692 MPa. Take the stress concentration factor for the threads as 3.85. The steel member has a net area of 320 mm^2. The load fluctuates continuously between 0 and 10690 N. Take the modified endurance limit $S_e = 207$ MPa.
   (a) Find the factor of safety, F_e, for the bolt when no preload is present. (15%)
   (b) Find the joint constant C, where $C = k_b/(k_b + k_m)$, k_b is the spring constant of the bolt; k_m is the spring constant of the member. (5%)





Fluctuating separating force versus time

⊕ **Make comments on the following statements (problems 6-10).** (Affirm a true statement and explain more facts; correct a false statement and give your reasons.)

6. In contrast to a mathematical problem, a design problem has no "*one right answer*". (6%)

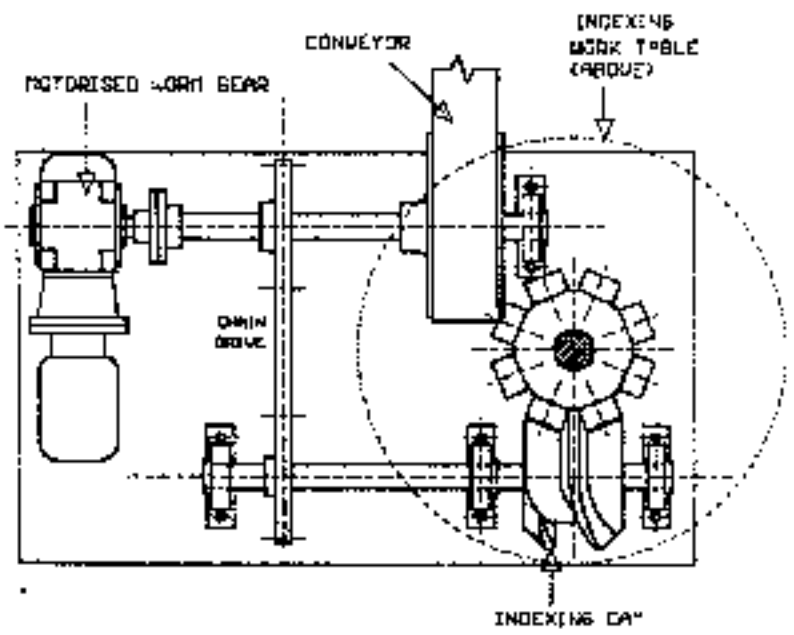
7. The tolerances of machine parts should be specified at the largest values that the operating or functional considerations permit. (6%)

8. The helical springs typically have an essentially linear force-deflection characteristic (constant spring rate). Belleville springs also have linear force-deflection characteristic. (6%)

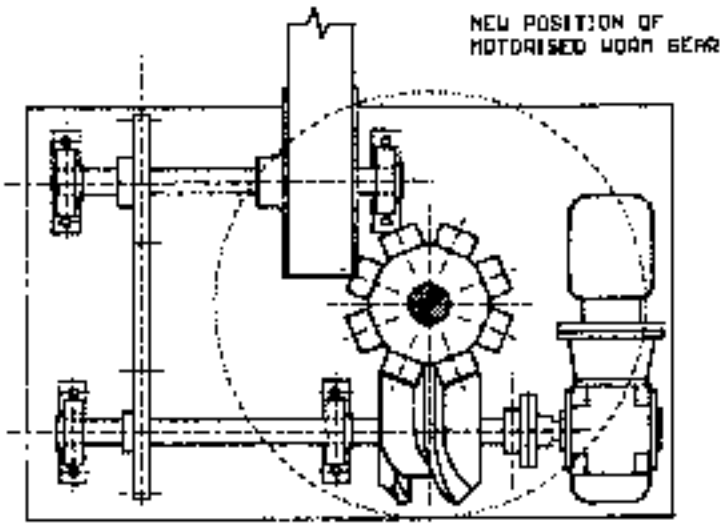
9. While various alloys of a given base material may vary markedly in terms of their strengths, they will have essentially the same modulus of elasticity. If deflection is the prime concern, a low-strength alloy is as good as a high-strength one of the same base material. (6%)

10. A keyway in the shaft usually has relatively sharp corners. This causes significant stress concentrations and also significantly affects the stiffness of the shaft. (6%)

11. The following figure shows two transmission designs for a feeding device. Each design has the same intended function, and has a constant speed conveyor and an indexing table, both of which are driven by the same motorized worm gear. Which one, Fig. (a) or Fig. (b), is the better design? Give your reasons. (10%)



(a)



(b)