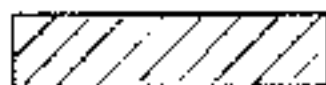


八十六學年度 動力機械 系(所) 丁 組碩士班研究生入學考試

科目 機械設計 科號 2901 共 2 頁第 1 頁 \*請在試卷【答案卷】內作答

- List five possible sources from which forces in machines arise. All these arisen forces must be considered in the design of a machine. (10%)
- Differentiate between the terms pitch and lead for any screw thread. (6%)
- A solid shaft with a length of 1000 mm is supported by two roller bearings at both ends. It has to transmit a torque of 1000 Nm and also carries a concentrated vertical load of 5000 N at its middle position. The permissible shear stress for the shaft is 150 MPa. The material is steel and has a modulus of elasticity of 207 GPa and a modulus of rigidity of 79 GPa. Determine the diameter if the angular deformation should not exceed 0.3° and the deflection should not exceed 0.8 mm. (16%)
- The following figures represent two possible cross sections through a simply supported beam that carries a load at the center. Namely, comparing with that in Fig. (a), the cross section in Fig. (b) has an added shallow rib. Is it possible that the addition of the shallow rib may cause an increase in stress rather than a decrease? (6%)



(a)



(b)

- One possible failure of spur gear teeth is static failure due to bending stress. List the factors that affect this stress. Explain how each of these factors affects the stress. (12%)

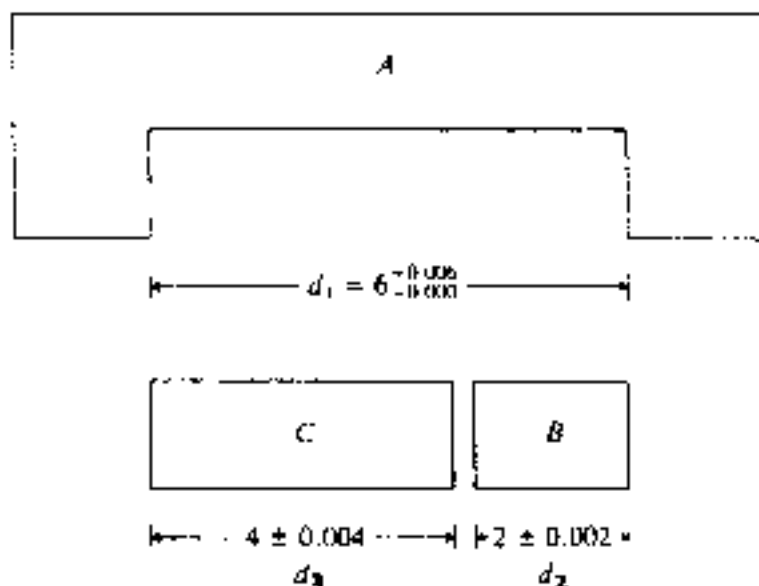
Two butt-welded plates with 0.5 in. thick are tensile-loaded rapidly between 5,000 and 15,000 lb. Since the weld reinforcement is not ground off, this results in a stress concentration ( $K_t = 1.2$ ) at the edge of the weld metal. An E60 series welding rod is used, giving tensile strength  $S_u = 62$  ksi, yield strength  $S_y = 50$  ksi, and unmodified endurance limit  $S_e = 0.5 S_u$ . A safety factor of 2.5 is to be used. What length ( $L$ ) of weld is required? (use Goodman's diagram). Assuming that the surface, size and load factors are  $k_s = 0.55$ ,  $k_z = 0.8$ , and  $k_c = 1$ , respectively. (20%)



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7. The following figure shows an assembly consisting of an inverted U-shape A with two parts B and C that must "just" fit into it when put end to end. The three parts have a 0.1% tolerance of their basic dimensions. The designer responsible for this design must answer the following question: Is interference possible to happen in the assembly? (10%)



8. A temporary construction elevator is to be designed to carry workers and materials to a height of 30 m. The maximum estimated load to be hoisted is 11,000 kg at a velocity not exceeding 0.6 m/sec. The sheave diameter (D) is 80 mm, the specification of the wire rope 25 mm-6 x 19, the wire diameter ( $d_w$ ) 2 mm, Young's modulus (E) 80 GPa, yield strength 700 MPa. If the acceleration is  $1.2 \text{ m/sec}^2$  and the factor of safety is chosen to be 10, find the number of ropes required. (20%)

Note: The stress  $\sigma = E \frac{d_w}{D}$ , and the weight of the rope is 2.2 kg/m