

1. 試將以下專業英文文句譯成中文。

- (a) Mechanical engineering is concerned with design, construction and operation of power plants, engines and machines. (5%)
- (b) The shaft is mounted so that the radial forces are carried by roller bearings and high axial thrust by two equally loaded ball bearings. (5%)
- (c) Plant room floors are necessarily heavy in order to support the weight of the mechanical equipment, a 12 inches floor being not uncommon. (5%)
- (d) An attempt to make the computer useful in the design process rather than just in design documentation is apparent in the next generation of CAD systems. (5%)
- (e) All real machines exist in three dimensions but many three-dimensional systems can be analyzed two dimensionally if their motions exist only in one plane or in parallel planes. (5%)

2. A square-thread screw jack is used to raise a load of F . The static friction and the lead angle of the thread are μ and λ , respectively.

- (a) Show that for zero collar friction the efficiency is given by the equation
efficiency = $\tan \lambda [(1 - \mu \tan \lambda) / (\tan \lambda + \mu)]$. (9%)
- (b) Show that in what condition does the system self-lock. A self-locking screw is one that requires a positive torque to lower the load. (8%)
- (c) Find the maximal efficiency and the corresponding λ , use $\mu = 0.08$. (8%)

(背面仍有題目,請繼續作答)

3. (25%) Figure 1 shows a gear train. Gear P transmits 21000 lb-in to gear A, and gear C delivers the torque to gear Q. The distance between gear A and bearing B is 15 in. The distance between bearing B and gear C is 15 in. The distance between gear C and bearing D is 10 in. The gears are 20-degree (pressure angle) spur gears. The pitch diameters of gears A and C are 20 in and 10 in, respectively. Draw the free-body diagram, shear force diagram, and bending moment diagram for the shaft in the x-z plane, and in the y-z plane.

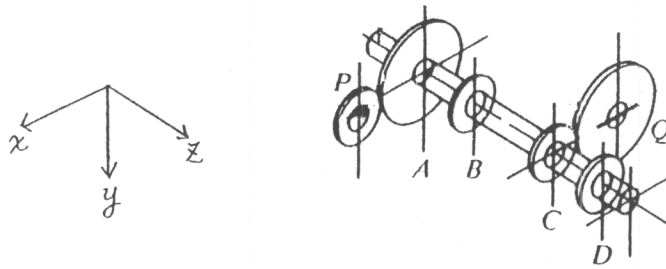


Figure 1

4. (25%) Figure 2 shows a short shoe drum brake. The lever is pivoted on pin A. The coefficient of friction is denoted by f . (a) Draw the free-body diagrams of the lever and the drum. (b) Given an actuating force W , determine the friction torque applied on the drum. (c) Derive the condition for the brake to be self-actuating, when no actuating force is required to actuate the brake. For a self-actuating brake, a negative (upward) W would be required to release the brake.

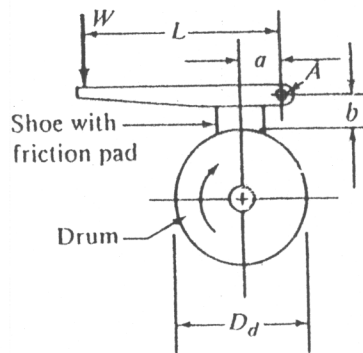


Figure 2