

※ 注意：請於試卷內之「非選擇題作答區」依序作答，並應註明作答之大題及小題題號。

1. **Figure 1** shows two meshing spur gears. A  $Z_1$ -tooth pinion drives a  $Z_2$ -tooth gear with a rotational speed of  $n_1$  to transmit a power of  $P$ . The gear module is  $m$ , and their pressure angle is  $\phi$ .  $[P]=W$ ,  $[n]=\text{rpm}$

Using the above mentioned parameters to determine the following parameters:

- (a) The torques of the pinion  $T_1$  and the gear  $T_2$ . (5 分)
- (b) The tangential force  $F_t$  and the radial force  $F_r$ . (5 分)

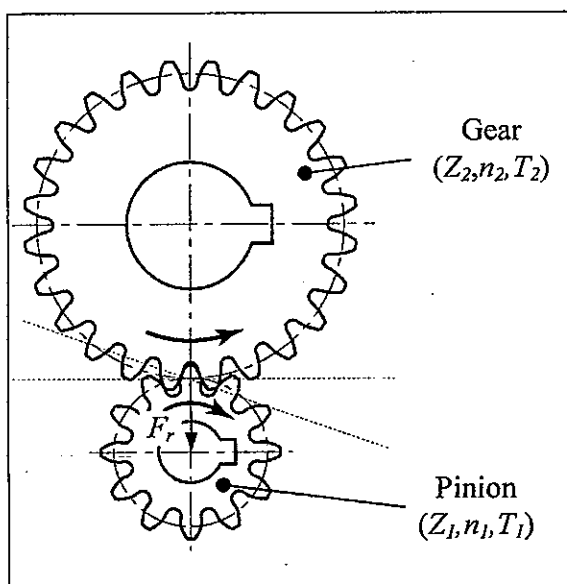


Fig.1 Two meshing spur gears

2. **Figure 2** shows a bolt cutter with its dimensional parameters, and  $F$  is the actuating force. Using the given parameters to determine the cutting force  $F_D$  for the  $d$ -diameter bolt. (8 分)

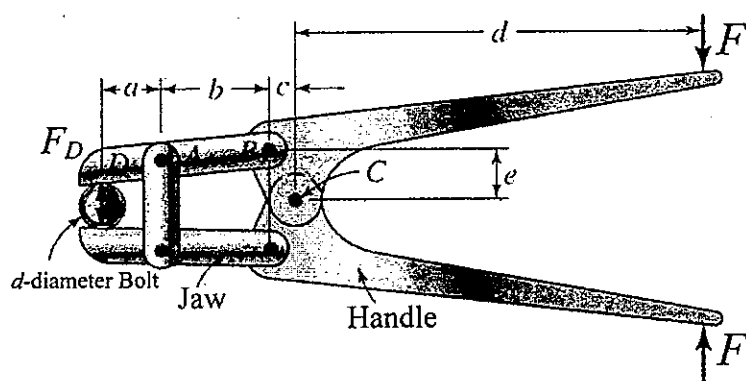


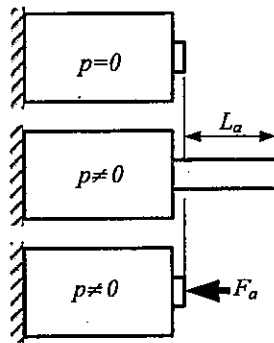
Fig.2 Bolt cutter with d-diameter Bolt

見背面

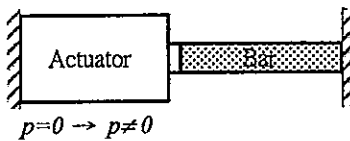
3. Figure 3 shows an actuator working against an diameter  $d$  by length  $L$  bar, whose Young's modulus is  $E$ . Through a hydraulic pressure of  $p$ , This actuator can generate a maximum stroke  $L_a$  for no load and a maximum force  $F_a$  for no stroke, and the maximum force  $F_a$  for no stroke is defined as  $F_a = C_p \cdot p$ .

Using the given parameters ( $d, L, E, p, L_a, C_p$ ) to determine the following parameters:

- (a) The spring constant of the bar  $k_{bar}$ . (6 分)
- (b) The relationship between the spring constant of the actuator  $k_a$  and the hydraulic pressure  $p$ . (6 分)
- (c) The actuating stroke  $L_w$  and the actuating force  $F_w$  for the actuating situation (Fig. 3(b)) by charging a pressure of  $p$ . (10 分)



(a) Actuator behaviour



(b) Actuator working against bar

Fig. 3 Actuator working against bar

4. As shown in the Fig. 4, a momentum  $M_B$  is applied to drive the drum  $B$  and maintain a constant speed in the polishing belt system.

Assume:

- (1)  $\mu_k = 0.45$  between the belt and the 15 kg block being polished;
- (2)  $\mu_s = 0.3$  between the belt and the drive drum  $B$ .

Determine:

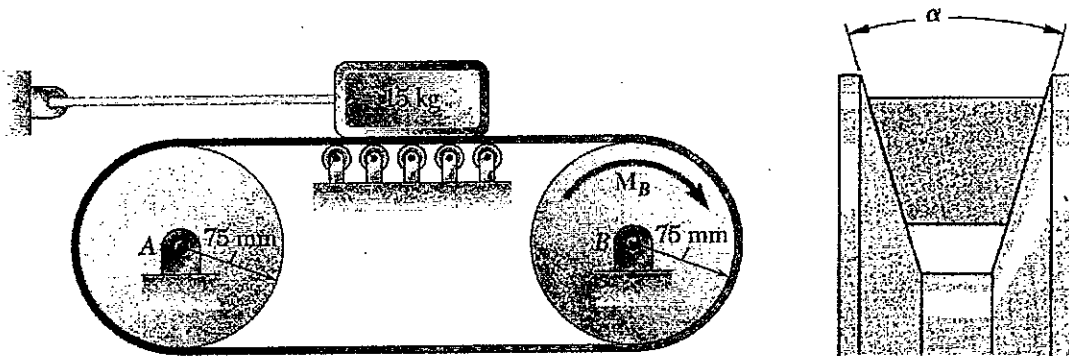
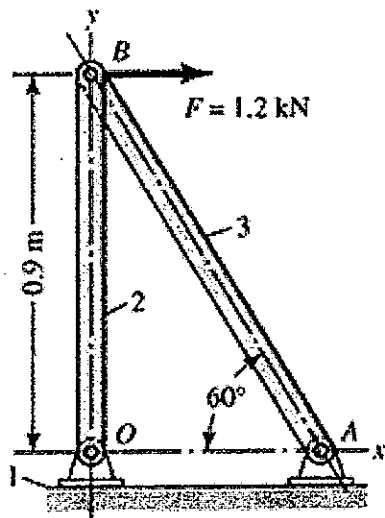


Fig. 4 The system of polishing belt

- (a) the couple of  $M_B$  (10 分),
  - (b) the minimum tension (20 分) in the lower portion of the belt,
- if there has no slipping between the belt and the drive drum. (The belt is V-shaped.  $\alpha = \pi/3$ )

5. The cross sections for the truss members are 2.5mm X 2.5 mm. (a) Find the stresses on each member. (6 分)  
(b) Indicate the stress types (compression or tension). (6 分)

Fig. 5



6. A hungry bear weighing 700 N walks out on a beam in an attempt to retrieve a basket of food hanging at the end of the beam. The beam is uniform, weighs 200 N, and is 6.00 m long; the basket weighs 80.00 N.
- (a) Draw a free-body diagram for the beam. (6 分)
- (b) When the bear is at  $x = 1.00$  m, find the tension in the wire and the components of the force exerted by the wall on the left end of the beam. (6 分)
- (c) If the wire can withstand a maximum tension of 900 N, what is the maximum distance the bear can walk before the wire breaks? (6 分)

Fig. 6

