機構學 (50%) (註: 本科考試不得參閱任何資料)

1. For the following statements, please give "+" for true statements and "-" for false statements. The score for each answer will be 2 points if it is correct, but -1 point if it is wrong, and 0 point for no answer. [10 points]
   (1) The Oldham coupling is an inversion of the Scotch yoke mechanism.
   (2) The pitch surface of a spiral bevel gear gear is a cone.
   (3) There is no interference between meshing cycloidal gears.
   (4) For crossed helical gears to mesh properly, the gears should be of opposite hand.
   (5) In choosing cam displacement curves, the harmonic motion provides zero acceleration at both ends of the action. Therefore it can be coupled with a dwell at each end.

2. Please give proper answer for each of the following problems. [20 points]
   (1) For the four-bar mechanism shown in Fig. 1, AoA = 9 cm, AB = 12 cm and BoB = 15 cm, what is range of values of AoBo with which the mechanism can be operated as a drag-link mechanism? ____(1)____.
   (2) The degree of freedom of the Peaucellier mechanism shown in Fig. 2 is _(2)_.
   (3) For the offset slider-crank mechanism shown in Fig. 3, the time ratio of working stroke to return stroke is ____(3)____.
   (4) A radial roller follower is to move through a total displacement of 0.75 in, with harmonic motion while the cam rotates 45°. The follower dwells for 30° and then returns with cycloidal motion in 50°. In order to keep the pressure angle less than 30°, the minimum radius of the pitch surface, Ro, need be __(4)__. (referring to Fig. 4)
   (5) A 42-tooth pinion cut with a 120-pitch, 20° full-depth hob drives a 90-tooth gear. The contact ratio for involute gears is ____(5)____.

Fig. 1

Fig. 2

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$O_2A = 3$ in.
$AB = 7$ in.

Fig. 3

Fig. 4
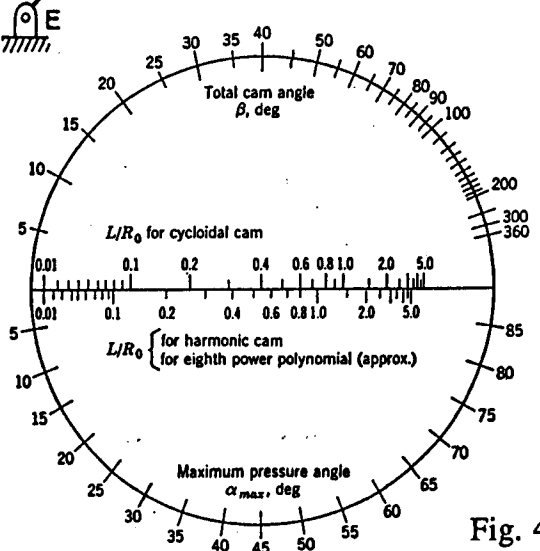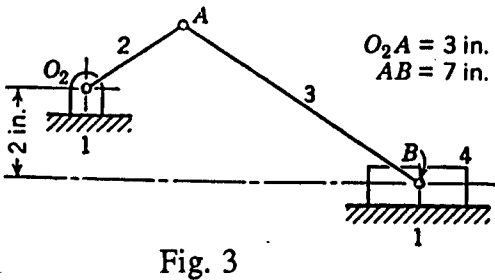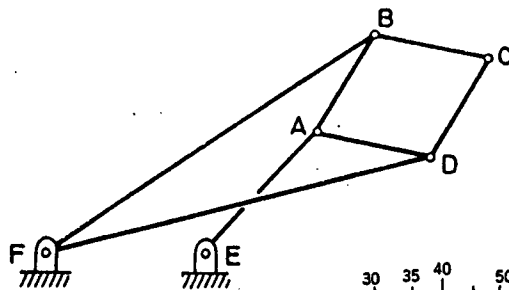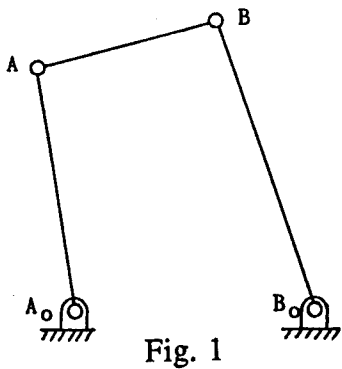
3. For the gear train shown in Fig. 5, the angular velocity of shaft A is 350 rad/s in the direction shown and that of shaft B is 2000 rad/s. Please determine the angular velocity of shaft C. [8 points]
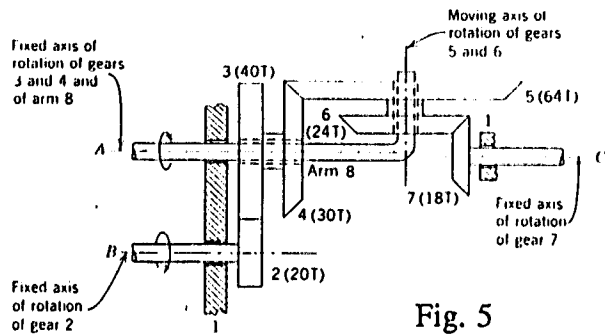

Fig. 5

4. A cam and <u>curved</u> follower are shown in Fig. 6, with point P on body 3 and point Q on body 2. Please complete the velocity and acceleration polygons and determine V_Q, ω_2, A_Q, and α_2. The scales are 1 cm = 500 mm/s and 1 cm = 2000 mm/s^2. [12 points]
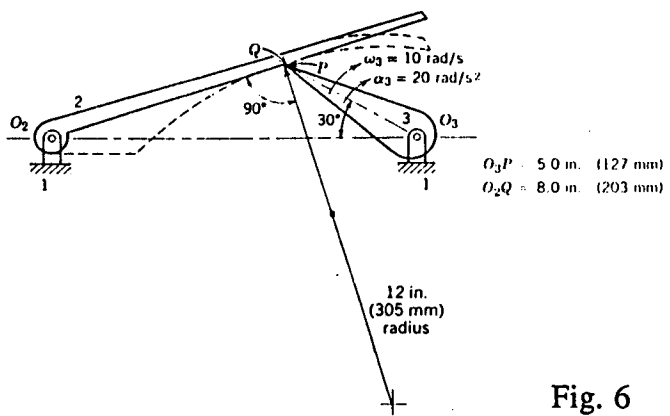

Fig. 6

機械設計 試題 (50%)

‧ (註: 本科考試中不得參閱任何資料。)

5. 試說明:
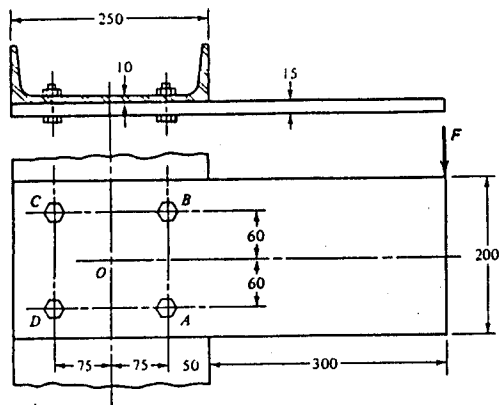   (1) 甚麼是安全因數(factor of safety)? (5%)
   (2) 甚麼原因設計時常須考慮安全因數? (5%)
   (3) 影響安全因數之值之因素有那些? (5%)　(共15%)

6. (1) 齒輪之設計要考慮那些要項? (7%)
   (2) 請簡述設計正齒輪(Spur gear)之主要步驟, 但設已知所傳遞之馬力, 兩軸間距離與兩軸轉速。(8%)
   　　　　　　　　　　　　　　　　　　　(共15%)

7. 有一鋼板擬以 4支螺栓(bolt)固定於槽形鋼(channel)上, 以承受偏心負荷 F = 14 KN, 如下圖所示。

圖中尺寸單位為 mm

   (1) 試求各螺栓中所受之最大負荷。(10%)

   (2) 試依螺栓所受之剪應力計算出其應有之螺栓直徑, 但安全因數取為 1.5, 又螺栓材料為 CNS S22C 鋼, 其抗拉強度為 420 MPa, 降伏強度為 300 MPa。
   　　　　　　　　　(10%)
   　　　　　　　　　(共20%)