壹. 機構學 (50%)

1. Please state the basic assumptions of the kinemtics (or mechanisms). [5]

2. Please determine the degrees of freedom of the planetary gear train shown in Fig. 1. Before that please indicate the number of links, types and number of joints. [5]

3. Please determine graphically the angular velocity and acceleration of shaped component shown in Fig. 2, if the crank OP rotates with a constant clockwise angular velocity of 10 rad/s. [10]

4. Please design a disk cam to produce the following motion of a translating flat-faced follower: a rise through distance h with simple harmonic motion during 180° of rotation, followed by a return, also with simple harmonic motion, during the remaining 180° of cam rotation; please also determine the lower bound of the width of the follower face. [10]

5. Two meshing standard 20°, full-depth spur gears, with a module of 4 mm, have 14 teeth and 45 teeth. What must be the actual operating pressure angle and the center distance, in order to avoid interference? [10]

6. Please design a drag-link quick-return mechanism, as shown in Fig. 3, with a 70 mm stroke, and the time ratio is 3. [10]
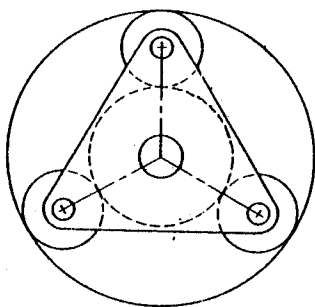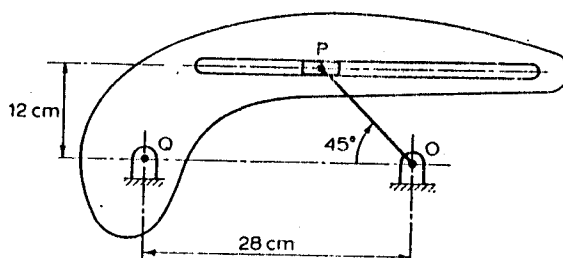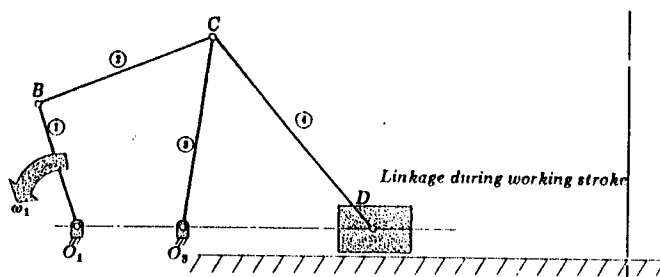

Fig. 1

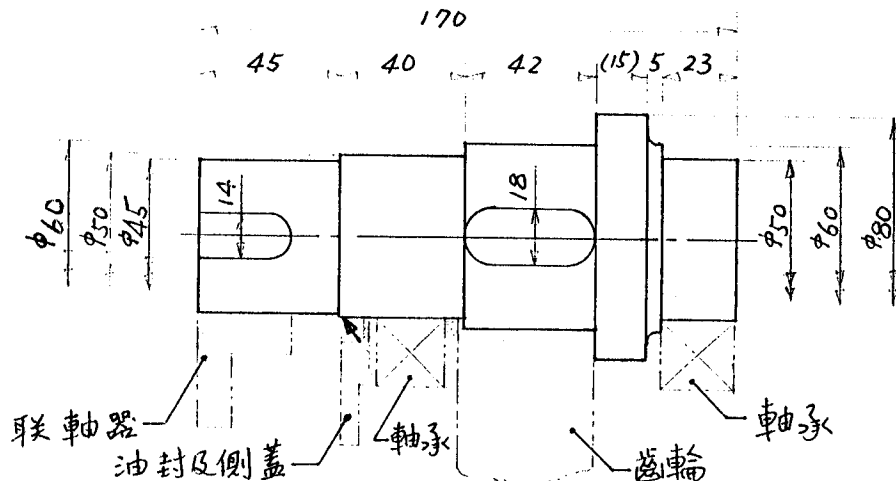12 cm
45°
28 cm

Fig. 2

Linkage during working stroke

Fig. 3

二、機械設計 (50%)

7. **(a)** 請描述你認為合理之機械設計過程(Mechanical Design Process)及其特性,試以圖示(可舉例)說明有那些步驟? **(b)** 各步驟之先決條件(Inputs)及結果(Outputs)。 **(c)** 設計之優劣可依那些辨別條件(Criteria)來判斷?(可舉例說明)。 (15%)

8. 滾動軸承(Rolling Contact Bearings)規格之選擇,及滑動軸承(Journal Bearings)之設計, **(a)** 有那些條件必需事先知道? 其中有那些項目可由設計者自行決定? **(b)** 若轉速 2,500rpm 之傳動軸,軸承位置直徑設計為 50mm,你會選用滑動軸承或滾動軸承?請說明理由。 (10%)

9. **(a)** 轉動軸在傳動系統中,如何協助組裝在軸上之元件扮演預期之功能?以簡圖舉例說明。 **(b)** 下圖中之傳動軸(黑色實線部份),有那些資料得再補充,才稱得上是設計完整之零件圖?請分項列舉說明(定性即可,不必定量)。 (10 %)

10.**(a)** 齒輪破壞的現象有那幾種?引起破壞的原因有那些? **(b)** 設計齒輪時,常以負荷下之應力與可選用之材料強度互相比較;請依你熟悉之經驗公式,說明估算各應力與強度時之影響因數,及其代表意義;應力及可用強度又如何比較。 **(c)** 請舉簡例說明設計過程中,設計者可自行決定那些項目。 (15%)