

國立臺北科技大學 102 學年度碩士班招生考試

系所組別：1120、1131 機電整合研究所乙、丙組

第二節 工程力學 試題 (丙組選考)

第一頁 共一頁

注意事項：

1. 本試題共 4 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

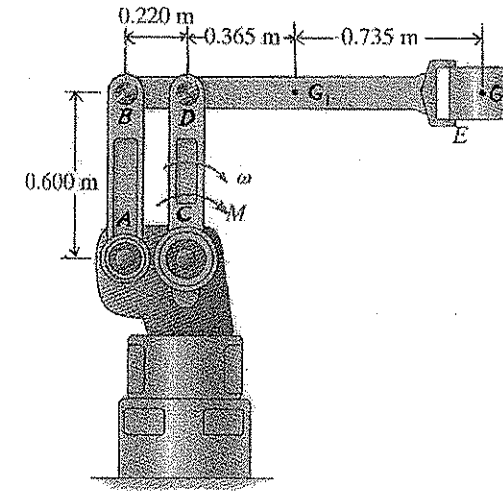


Fig. 2

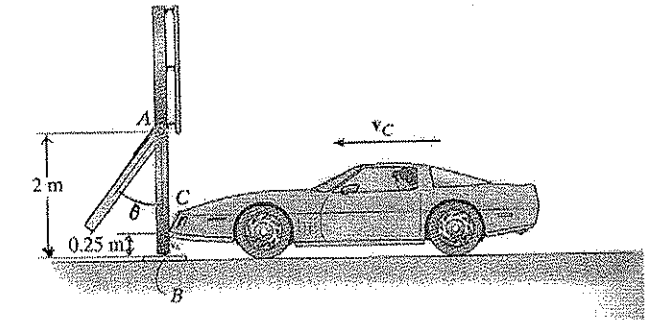


Fig. 3

1. Fig.1 shows an adjustable toggle plier. It mainly consists of four links (numbered by 1,2,3,4) which are connected by revolute joints. In the position shown, AB is parallel to CD, $\angle CAB = 27^\circ$, $\angle DBA = 81^\circ$ and angular velocity ratio of link 3 to link 4 is 1.875. If the applied force $F_{in} = 25$ N, determine the magnitude of output force, F_{out} . Neglect the frictions at joints and the effects of inertia forces. (25%)

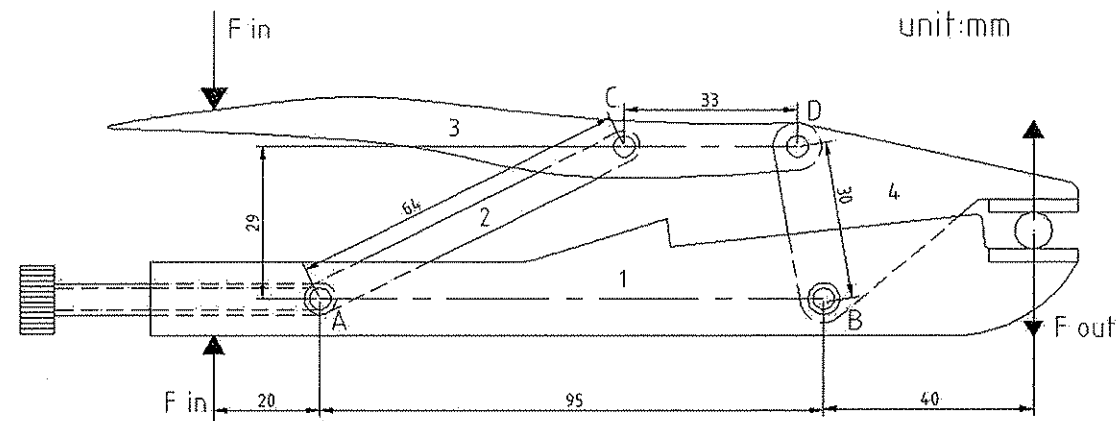


Fig. 1

2. Arm BDE of the industrial robot, shown in Fig. 2, is activated by applying the constant torque of $M = 30$ N·m to link CD. Determine the reactions at pins B and D when links AB and CD are in the position shown and have an angular velocity of 2 rad/s and zero angular acceleration. Arm BDE has a mass of 12 kg with center of mass at G_1 . The container held in its grip at E has mass of 10 kg with center of mass at G_2 . Neglect the mass of links AB and CD. (25%)

3. For safety reasons, the 18-kg supporting leg of a sign is designed to break away with negligible resistance at B when the leg is subjected to the impact of a car as shown in Fig. 3. Assuming that the leg is pinned at A and approximates a slender rod, determine the linear impulse the car bumper exerts on it, if after the impact the leg appears to rotate clockwise to a maximum angle of $\theta_{max} = 120^\circ$. Neglect the friction at pin joint A. (25%)
4. As shown in Fig. 4, the ring gear is fixed. The mass of the sun gear is $m_S = 20$ slugs, and moment of inertia about its center of mass of the sun gear is $I_S = 4200$ slug-ft². The mass and moment of inertia (about its center of mass) of each planet gear are $m_P = 2.5$ slugs and $I_P = 60$ slug-ft², respectively. If a couple $M = 500$ ft-lb is applied to the sun gear, determine the angular velocity of the sun gear after it has turned 120 revolutions. Assume the system starts from rest. (25%)

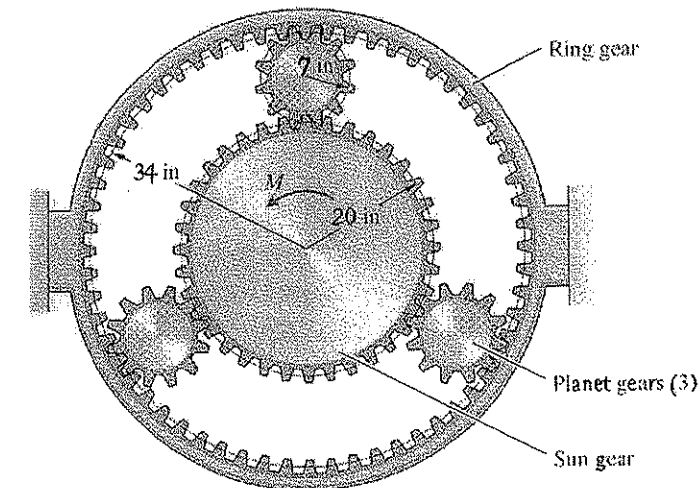


Fig. 4