MECHANICAL MATERIALS

一、

1. 考慮圖 1 所示的相圖，請找出其中的所有三相反應。 (10%)

2. 請略述析出強化處理的方法。 (6%)

3. 不銹鋼主要添加元素的目的何在? (5%)

4. 鋁大量用於食品之包裝容器，如易開罐、鋁箔紙罐等，請問那些特性
造就它在這方面的應用。 (4%)

二、

5. Fig.2 shows the continuous cooling transformation diagram for a 0.35 wt% C iron-carbon alloy. Name the microstrutures which are corresponding to the continuous cooling curves lebelled (a), (b), (c), (d) and (e). (10%)

6. Brief explain why, for a small anode-to-cathode area ratio, the corrosion rate will be higher than for a large ratio. (5%)

7. Why must rivets of a 2017 aluminum alloy be refrigerated before they are used? (5%)

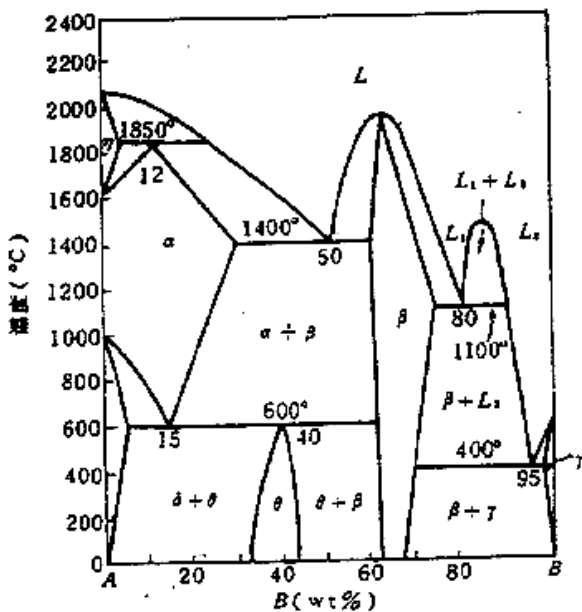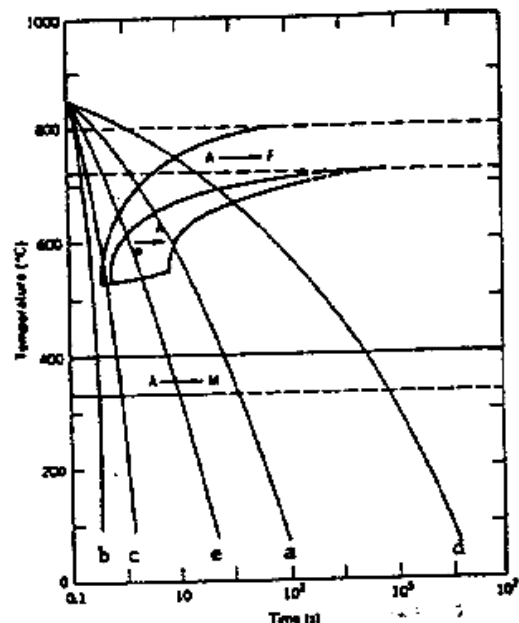8. What is the pricipal difference between wrought and cast alloys? (5%)

圖 1　假想之相圖

Fig.2. The continuous cooling transformation diagram for a 0.35wt% C iron-carbon alloy.

MECHANICS OF MATERIALS

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三、(1) A sleeve in the form of a circular tube of length L is placed around a bolt and fitted between washers at each end (Fig.1). The nut is then turned until it is just snug. The sleeve and bolt are made of different materials and have different coefficients of thermal expansion α_s and α_b, respectively. If the temperature of the entire assembly is raised by an amount ΔT, what stresses σ_s and σ_b are developed in the sleeve and bolt, respectively? (12%)

Fig. 1
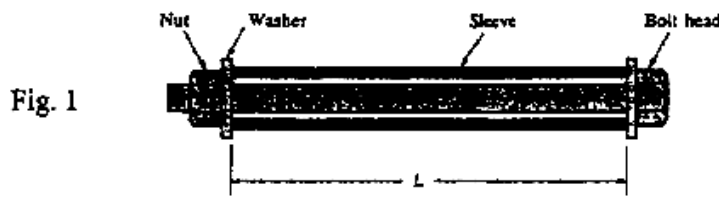
(2) The beam ABC shown in Fig. 2 has simple supports at A and B and an overhang from B to C. A uniform load of intensity q = 3.0 kN/m acts throughout the length of the beam. The beam is constructed of steel plates (12 mm thick) welded to form a channel section, the dimensions of which are shown in Fig. 3. Calculate the maximum tensile stress in the beam due to the load q. (13%)
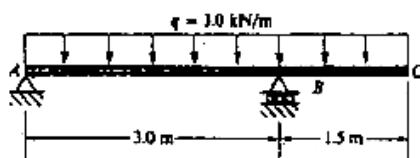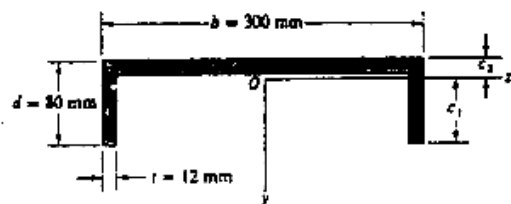

Fig. 2

Fig. 3

四、

1. A *cantilever beam* is loaded with a point couple M_0 at the *free end*. Using *Castigliano's theorem* to determine the slope of the deflection curve at position $x = L/2$, where L is the total length of the cantilever beam. Assume linear elastic behavior. (Hint $\theta_i = \dfrac{\partial U}{\partial M_i}$)　(12 %)

2. A solid circular shaft of 2 *in.*-diameter is fixed to the wall at the right end and subjected to a downward transverse force $P = 100$ *lb* and a torque $T = 1000$ *lb·in.* as shown in the figure. Determine the combined shear stress at $a-a$, 50 *in.* from the free end due to P and T. (13%)
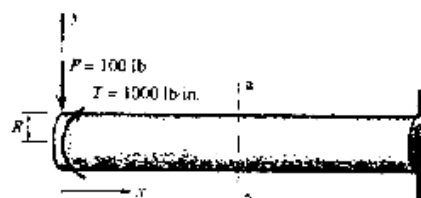

Figure　　Solid circular shaft subjected to torque and transverse force