

系所組別： 機械工程學系丁組

考試科目： 機械製造及材料

考試日期： 0219，節次： 2

※ 考生請注意：本試題 可 不可 使用計算機

1、In manufacturing the overhead transmission shaft AE is driven at a constant speed by an electric motor connected by a flat belt to pulley B (see Fig. 1). Pulley C may be used to drive a machine tool located directly below C, while pulley D drives a parallel shaft located at the same height as AE. Knowing that $T_B + T'_B = 36 \text{ lb}$, $T_C = 40 \text{ lb}$, $T'_C = 16 \text{ lb}$, $T_D = 0$, $T'_D = 0$, determine (a) the tensions T_B and T'_B , (b) the reactions at the bearings A and E caused by the tension in the belts. (10%)

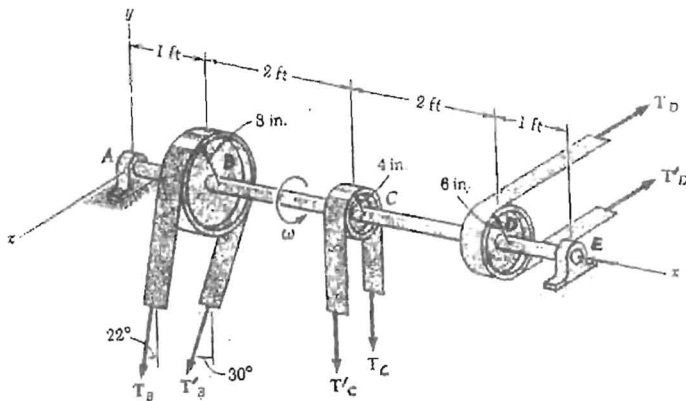


Fig. 1

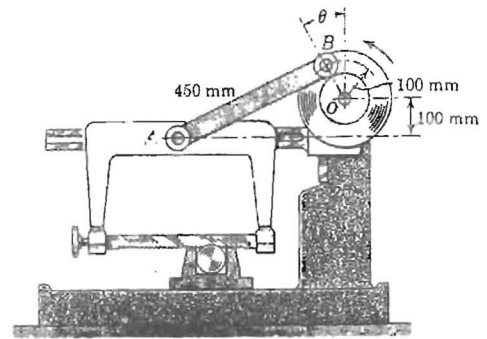


Fig. 2

2、The elements of a power hacksaw are shown in Fig. 2. The saw blade is mounted in a frame which slides along the horizontal guide. If the motor turns the flywheel at a constant counterclockwise speed of 60 rev/min, determine the acceleration of the blade for the position where $\theta = 90^\circ$, and find the corresponding angular acceleration of the link AB. (15%)

3、In a drilling operation using a twist drill, the rotational frequency of a drill is 5 sec^{-1} , the feed 0.25 mm, the major cutting edge angle 60° , and the drill diameter 12 mm. Assuming that the specific cutting energy for the work material is 2 GJ/m^3 , calculate

- (a). The maximum metal-removal rate, in micrometers cubed per second ($\mu\text{m}^3/\text{sec}$) (5%)
- (b). The undeformed chip thickness, in millimeters (mm) (5%)
- (c). The drill torque, in newton-metres (Nm). (5%)

- 4 (a). Explain why a casting may have a slightly different shape than the pattern used to make the mold. (5%)
- (b). Name the important factors in selecting sand for molds. (5%)

(背面仍有題目,請繼續作答)

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5. Explain or distinguish the following terms: (12%)
 - (a) Hardness vs Toughness
 - (b) Young's modulus vs Poisson's ratio
 - (c) Fatigue vs creep
6. (a) Calculate the atomic packing factors of BCC and FCC. (4%)
 - (b) Which diffusion is faster for carbon interstitial diffusion in α -Fe and γ -Fe? Why? (2%)
 - (c) What are the Fick's first and second laws for diffusion? (4%)
 - (d) Cite two reasons why interstitial diffusion is normally more rapid than vacancy diffusion. (4%)
7. (a) The surface energy of a single crystal depends on the crystallographic orientation with respect to the surface. Explain why this is so. (2%)
 - (b) For an FCC crystal, such as aluminum, would you expect the surface energy for a (100) plane to be greater or less than that for a (111) plane? Why? (4%)
8. Below is the Fe-Fe₃C phase diagram, please answer the following questions.
 - (a) What are the eutectic and eutectoid reactions in Fe-Fe₃C system? Explain them. (4%)
 - (b) What is the pearlite microstructure? Compute the mass fractions of α ferrite and cementite in pearlite. (6%)
 - (c) What is the proeutectoid phase for an iron-carbon alloy in which the mass fractions of total ferrite and total cementite are 0.90 and 0.10, respectively? Why? (4%)
 - (d) What is the proeutectoid phase for an iron-carbon alloy in which the mass fractions of total ferrite and total cementite are 0.88 and 0.12, respectively? Why? (4%)

