國立中央大學八十五學年度碩士班研究生入學試題卷

所別: 機械工程研究所　乙組　科目: 機械材料及材料力學　共 2 頁 第 1 頁

PART I. METALLIC MATERIALS (50%)

1. Answer the questions and give your reasons briefly. (25%)

(a). Which metal is more ductile between copper and zinc? why? (4%)
(b). Is {111} and <110> a good slip system for fcc metal or for bcc one? why? (4%)
(c). Schematically construct a binary phase diagram at 1 atmosphere for an isomorphous alloy system by a set of cooling curves. (4%)
(d). Is it possible to obtain a peritectic alloy in Fe-C system? Sketch a phase diagram to show the peritectic point. (4%)
(e). Is the practically measured strength of a material less than that predicted theoretically? Give your reason. (4%)
(f). Does the atmospheric corrosion of iron involve electrochemical reactions? Give your reason. (5%)

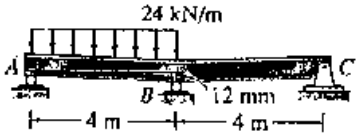
2. Answer the following questions. (25%)

(a). Compare the magnification capabilities of an electron microscope with an optical microscope. (5%)
(b). Explain the difference between hardness and hardenability. (5%)
(c). What is the secondary hardness in high-speed tool steels? (4%)
(d). Describe the processes and mechanism of precipitation hardening. (6%)
(e). What effect does the grain size have on the hardness of steel when quenched? (5%)

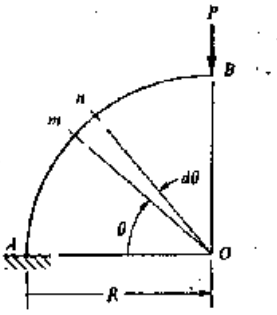
PART II MECHANICS OF MATERIALS (50%)

1.

(1) Determine the reactions on the beam shown in the figure. Due to the loading and poor construction, the roller support at B settles 12 mm. Take E=200GPa, and $I = 80(10^6) mm^4$. (Note that you **must** have to solve the problem by using the method of superposition) (15%)

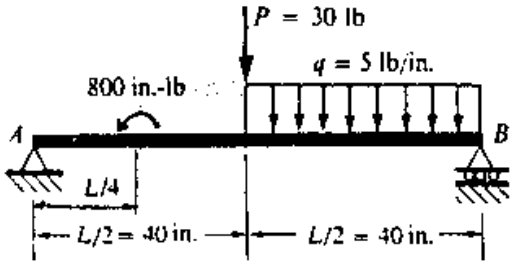


(2)A curve bar AB has a centerline in the form of a quarter circle of radius R, as shown in the figure. The bar has a fixed support at A and carries a vertical load P at the free end B. Obtain an expression for the horizontal deflection δ_h of point B. (10%)



2. (a) Construct the shear-force and bending-moment diagrams for the beam as shown in Fig. A. (10%)

Fig. A



(b) A tapered cantilever beam AB of length L has circular cross sections and supports a concentrated load P at the free end (see Fig. B). The diameter of the beam varies linearly from d_a at the free end to d_b at the fixed end. At what distance x from the free end does the maximum normal stress due to the load P occur if $d_b/d_a = 2.5$? What is the magnitude of the maximum normal stress σ_{max}? What is the ratio of this stress to the largest stress σ_b at the support? (15%)

Fig. B