

## 國立台灣科技大學一百學年度碩士班招生試題

系所組別：機械工程系碩士班戊組

科目：工程材料(二)

(總分為100分)

1. A 850-lb force is applied to a 0.15-in. diameter nickel wire having yield strength of 45,000 psi and tensile strength of 55,000 psi. Determine (a) whether the wire will plastically deform and (b) whether the wire will experience necking. (a and b, 各 5 分, 計 10 分)
2. A 0.25-in.-diameter copper bar is to be cold worked 63%. Find the final diameter. (10 分)
3. A liquid cast iron has a density of  $7.65 \text{ g/cm}^3$ . Immediately after solidification, the density of the solid cast iron is found to be  $7.71 \text{ g/cm}^3$ . (a) Determine the percent volume change that occurs during solidification. (b) Does the cast iron expand or contract during solidification? (a and b, 各 5 分, 計 10 分)
4. A Pb-Sn alloy contains 23% primary  $\alpha$  and 77% eutectic microconstituent. Determine the composition of the alloy. The compositions of Sn in primary  $\alpha$  and eutectic microconstituent are 19 and 61.9%, respectively. (10 分)
5. A steel contains 8% cementite and 92% ferrite at room temperature. (a) Estimate the carbon content of the steel. (b) Is the steel hypoeutectoid or hypereutectoid? The carbon concentrations of both ferrite and cementite are 0 and 6.67% at room temperature, respectively. (a and b, 各 5 分, 計 10 分)
6. List the carbon concentrations in the following steels: (a) 1015, (b) 1035, (c) 1095, and (d) 10130. (a, b, c, and d, 各 2.5 分, 計 10 分)
7. We have found that a 1070 steel, when austenitized at  $750^\circ\text{C}$ , forms a structure containing pearlite and a small amount of grain boundary ferrite that gives acceptable strength and ductility. What changes in the microstructure, if any, would be expected if the 1070 steel contained an alloying element, such as Mo or Cr? Explain. (10 分)
8. What are the mechanisms of strengthening in metals? (10 分)
9. What is the influence of the annealing on the heavily cold-worked metals at high temperature? (10 分)
10. Draw the crystal structures of (a) diamond and (b) zinc blende. (a and b, 各 5 分, 計 10 分)

