※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Figure 1 shows the tensile stress-strain diagram for steels containing different carbon content.

   (a) Determine the ultimate strength at each carbon content. Plot the relationship between the strength and the carbon content. (10%)

   (b) Determine the elongation percentage at each carbon content. Plot the relationship between the elongation percentage and the carbon content. (10%)

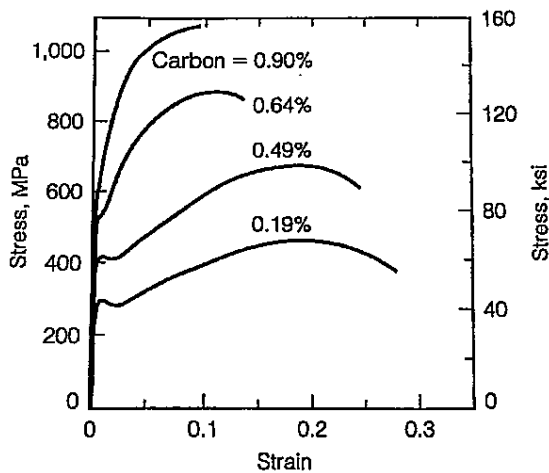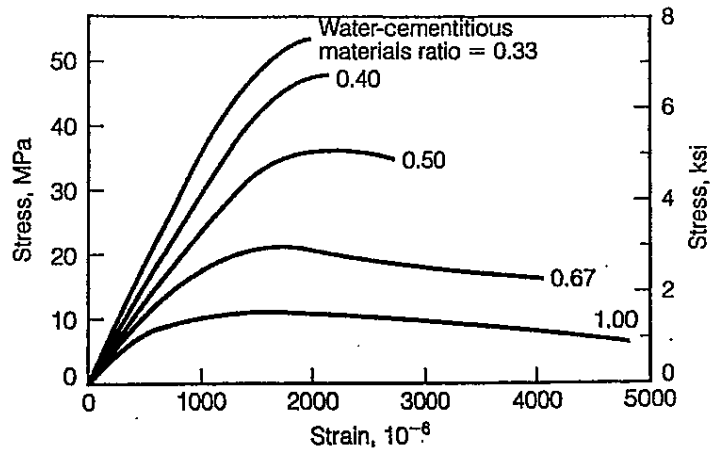   (c) Summarize the effects of the carbon content, and explain why. (10%)

Figure 1

Figure 2

2. Figure 2 shows the compressive stress-strain diagram of concrete specimens with different water-cementitious ratio.

   (a) Determine the ultimate strength at each water-cementitious ratio. (5%)

   (b) Determine the secant modulus at 40% of the ultimate strength at each water-cementitious ratio. (5%)

   (c) Plot the relationship between the secant modulus and the compressive strength. Estimate the elastic modulus of a concrete having a compressive strength of 30MPa using the plot. (10%)

   (d) Summarize the effects of the water-cementitious ratio and explain why. (10%)

3. Explain

   (a) Striation and endurance limit in fatigue (10%)

   (b) Percent air voids, voids in the mineral aggregates, and voids filled with asphalt for asphalt concrete (10%)

   (c) Dislocation climbing in metal creep (10%)

   (d) Sulfate attack in concrete (10%)