編號： 105

# 國立成功大學 105 學年度碩士班招生考試試題

系　　所：土木工程學系

考試科目：工程材料學

考試日期：0227，節次：2



※ 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. The Lennard-Jones type interatomic potential ($U$) between two atoms is as follows. Show that when m is greater than n, i.e. m > n, the material governed by the potential cannot be stable due to the lack of an energy minimum. (10%)

$$U = -\frac{A}{r^m} + \frac{B}{r^n}$$

2. Discuss the meaning and significance of the da/dN vs. ΔK curves in quantifying the fatigue properties of metal. (10%)

3. Discuss major chemical reactions in cement hydration to generate the C-S-H phase, as well as its microstructures. (10%)

4. About Portland cement, discuss the roles of (a) pozzolan, (b) gypsum, (c) $CaCl_2$, (d) $C_3A$, (e) $C_4AF$. (10%)

5. Discuss the Fuller-Thompson maximum density for the ideal gradation of aggregates. (10%)

6. Use the Maxwell rheological model to predict creep strain. (10%)

7. Define the following terms: (a) bulk modulus, (b) creep compliance, (c) relaxation modulus, (d) loss tangent, (e) flow stress. (10%)

8. Based on the iron-carbon binary phase diagram, discuss the mechanical properties and microstructures of the alloys when carbon content is (a) 0.8% and (b) 4.3%, in weight percent. (10%)

9. Discuss four different strengthening mechanisms for metal. (10%)

10. A prismatic rod, with square cross section, under uniform tensile stress 30 MPa is measured to have tensile strain 0.001, and lateral strain 0.0001. What is its Young's modulus, Poisson's ratio and shear modulus? Assume the material under test is isotropic, and no nonlinear behavior is observed. (10%)