國立臺灣科技大學
九十一學年度博士班招生考試試題
系所組別：機械工程系甲二組
科　目：最佳設計

總分 100 分

1. Explain (concept and/or mathematical conditions) the following terminology:
(a) Simulated Annealing (5%)
(b) Exterior Penalty Function Method (5%)
(c) Conjugate Direction Method (5%)
(d) Inequality constraints (5%)
(e) Quasi-Newton Method (5%)
(f) Golden Section Method (5%)
(g) Feasible and Usable Direction (5%)
(h) Steepest Descent Method (5%)

2. Consider the following function:

$$F(x) = 1 - 3x + e^{2x}$$

(a) Use the function values at x = 0.0, 0.3, and 0.5 to construct the approximate quadratic polynomial function for F(x). (15%)
(b) Use the approximate function to find the value of x that gives the minimum value of F(x). (10%)

3. Given the following optimization problem:

$$\begin{aligned} \text{Minimize:} \quad & F = X_1 + X_2 \\ \text{Subject to:} \quad & g_1 = 2 - X_1^2 - X_2 \le 0 \\ & g_2 = 4 - X_1 - 3X_2 \le 0 \\ & g_3 = -30 + X_1 + X_2^4 \le 0 \end{aligned}$$

Prove that the design ($X_1 = 1, X_2 = 1$) satisfies the Kuhn-Tucker necessary conditions for a constrained optimum. (20%)

4. In genetic algorithms, crossover is the mechanism of creating new gene combinations on offspring designs from parental designs. Please define in detail the operation of the following two crossover types:
(a) Two point crossover (10%)
(b) Uniform crossover (5%)