

Q 8130

M.E. DEGREE EXAMINATION, MAY/JUNE 2006.

Second Semester

Engineering Design

ED 1651 — OPTIMIZATION TECHNIQUES IN DESIGN

(Common to ME – CAD/CAM)

(Regulation 2005)

Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by objective function?
2. Define design constraints.
3. What is a unimodal function?
4. Deduce Golden section ratio.
5. What is meant by cross-over in genetic algorithm.
6. Define Lagrange multipliers.
7. What are the design parameters in the design of springs?
8. What is the role of cross-section of machine elements in designs involving compressive stresses?
9. Define mechanism.
10. List the variables in single degree of freedom vibration absorbers.

PART B — (5 × 16 = 80 marks)

11. (i) With suitable example explain an optimum design procedure for a four-bar mechanism. (8)
- (ii) Explain the optimization procedure for the design of suspension system for an automobile. (8)

12. (a) With a typical engineering application explain elaborately formulation of an optimization problem.

Or

- (b) (i) Enumerate the classification of optimization problems applicable for engineering design.
(ii) Write briefly with suitable examples about adequate design and optimum design.

13. (a) Use five iterations of Golden section search method in order to maximize the function $f(x) = 10 + x^3 - 2x - 5e^x$ in the interval $(-5, 5)$.

Or

- (b) Perform two iterations of Hook-Jeeves pattern search method with base point as $(2, -1, 0, 1)^T$ and perturbation $\Delta = (1, 1, 1, 1)^T$ for minimizing the following four-variable problem

$$f(x_1, x_2, x_3, x_4) = (x_1 + 2x_2 - 1)^2 + 5(x_3 - x_4)^2 + (x_2 - 3x_3)^4 + 10(x_1 - x_4)^4$$

14. (a) (i) State and explain the necessary and sufficient conditions according to Kuhn-Tucker.
(ii) Explain briefly with suitable examples on penalty functions used in constrained optimization.

Or

- (b) With a typical example explain in detail the procedure followed by Genetic Algorithm in determining the global minimum of an engineering problem.

15. (a) Explain the optimization methods used in the design of truss members with suitable example.

Or

- (b) Formulate the objective function for the design of (i) coil springs in valve operation (ii) Lathe spindle (iii) shock absorber.