

M.Tech. Mechanical Engineering Design (CBCS) Semester - II  
**MED23 - Optimization Techniques in Design**

P. Pages : 2

Time : Three Hours



**GUG/S/23/14195**

Max. Marks : 70

- Notes :
1. All questions carry equal marks.
  2. Due credit will be given to neatness and adequate dimensions.
  3. Assume suitable data wherever necessary.
  4. Illustrate your answers wherever necessary with the help of neat sketches.
  5. Solve **any five** questions.

1. a) Give an statement of an optimization and classified optimization problem with suitable example. 7  
b) What is constraint? and describe the multivariable optimization with Equally and unequally constraint? 7
2. a) Explain with suitable example of Lagrangian Multipliers method. 7  
b) Using Kuhn Tucker condition prove that the Profit maximizing outputs will be such that prices at off-peak periods will merely cover marginal operating costs (raw material, labor, etc.), while in peak periods the prices will exceed marginal operating costs. The sum of the excesses of these prices over marginal operating costs for all peak periods will just add up to marginal capital cost, i.e., they will sum to the marginal cost of increasing capacity. 7
3. a) Write down the characteristics of optimization techniques with constraints problem. 7  
b) Prove that The firm does not equate the marginal rate of factor substitution to the ratio of the input prices. The firm has an incentive to increase its investment: The amount of capital used with the regulatory constraint is not less than the amount used without a constraint using Kuhn Tucker condition. 7
4. a) Using Geometric Programming technique prove that the log-sum-exp function  $f(x) = \log \sum_{i=1}^n e^{x_i}$  is convex in  $x$ . 7  
b) What is constraint? and describe the multivariable optimization with equally and unequally constraint? 7
5. a) Discuss briefly the optimization Conjugate gradient method and Variable metric method. 7  
b) What your idea about integer programming and Graphical representation in optimization technique. 7

6. Use the method Fibonacci to minimize  $(x_1, x_2) = 4(x_1)^2 + 6(x_2 - 6)^2$  The initial simplex has the following three vertices A (8, 9), B (10, 11), C (8, 11) Carry out 4 iterations
- a) What is the first approached in optimization technique in (i) theory of bending and theory of elongation? **7**
- b) Explain the technique of constrained optimization in relation to utility functions and how it work. **7**
7. a) A Post Office requires different numbers of employees on different days of the week. Union rules state each employee must work 5 consecutive days and then receive two days off. Find the minimum number of employees needed. **7**
- |              | Mon | Tue | Wed | Thus | Fri | Sat | Sun |
|--------------|-----|-----|-----|------|-----|-----|-----|
| Staff Needed | 17  | 13  | 15  | 19   | 14  | 16  | 1   |
- b) What your idea about integer programming and Graphical representation in optimization technique. **7**
8. a) Discuss briefly the optimization Conjugate gradient method and variable metric method. **7**
- b) What your idea about integer programming and Graphical representation in optimization technique. **7**

\*\*\*\*\*