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BIMEE-022

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B.Tech. MECHANICAL ENGINEERING (BTMEVI)

Term-End Examination
December, 2013

BIMEE-022 : OPTIMIZATION FOR ENGINEERING DESIGN

Time : 3 hours *Maximum Marks : 70*

Note : *(i)* *Answer **any five** questions.*
(ii) *Scientific calculator is **allowed**.*

1. (a) Explain the classification of optimization algorithms. **10**

(b) Explain the optimal design procedure with the help of a neatly sketched flow chart. **4**

2. (a) Compare the bisection and secant methods in terms of the obtained interval after 10 function evaluations for the minimization function : **10**

$f(x) = \exp(x) - x^3$

in the interval (2, 5). How does the outcome change if an interval $(-2, 5)$ is chosen ?

(b) Identify the optimum points of the following functions : **4**

$f(x) = (x-1)^2 - 0.01x^4$

Find the optimum function values.

3. Consider the constrained optimization problem : **14**
Minimize

$10x_1^2 + 2.5x_2^2 - 5x_1x_2 - 15x_1 + 10$

subject to

$x_1^2 + 2x_2^2 + 2x_1 \leq 5$

Find whether any of the following points are likely candidates of the optimum points :

(a) $(0, 0)^T$ (b) $(0.1, 0.1)^T$ (c) $(2, 1)^T$

4. Use two iterations of the cutting plane method to solve following problem 14

Maximize $f(x) = x_2$

Subject to $4.5x_1 + x_2^2 \leq 18$,

$2x_1 - x_2 \geq 1$,

$x_1, x_2 \geq 0$

Choose a suitable initial feasible region.

5. Discuss in detail the algorithm of variable elimination method and random search method for solving multivariable constrained problem in optimization. 14

6. Solve the following problem using GP method : 14

Minimize $xy^2 - 3(y-1)^2$

subject to $x^2 - 6x + y \leq 0$,

$x \geq 3$, $y \geq 2$.

7. Discuss the differences and similarities between GA and traditional method. 14