**FACULTY OF ENGINEERING & TECHNOLOGY**
**M.E(Mechanical) Year Examination - June– 2015**
**Advanced Optimization Techniques**
**(Revised)**

[Time:  Three *Hours*]                                      [Max. Marks: 80]

"Please check whether you have got the right question paper."

i)   Attempt <u>any three</u> questions from each section.
ii)  Assume additional data if necessary
iii) Use of non-programmable calculator is allowed.

## SECTION-A

Q.1  a)  What is one dimensional minimization problem?                                      06
     b)  Find the optimum function value for the following function $f(x) = (x-1)^2 - 0.01x^4$ using      07
         exhaustive search method within (0,3)

Q.2      Bracket the minimum of the function $f(x) = x^2 - 3x - 20$ using bounding phase method. Use an      13
         initial point $x^{(0)} = 0$ and initial  $\Delta = 1$.

Q.3      Use gradient based method to optimise the function                                      13
         Minimize $f(x_1, x_2) = (x_1^2 + x_2 - 11)^2 + (x_1 + x_2^2 - 7)^2$

Q.4      Write down the kuhn-Tucker conditions for the NLP problem mentioned below      13
         Minimize $x_1^2 + x_2$
         Subjected to $g_1(x) = 10\exp(x_1^2 + x_2) - 5x_1 + 12 \geq 0$
                     $g_2(x) = 5x_1^3 + 2x_2 - 9 \leq 0$
                     $0 \leq x_1, x_2 \leq 3$
         Check if $(0,1)^T$, $(1,4)^T$ are K-T points.

Q.5      Write short notes (<u>any two</u>)                                      14
         i)      Hession Matrix
         ii)     Optimality Criteria
         iii)    Single Variable Optimization.

## SECTION-B

Q.6      Old hens can be bought for Rs2 each but young ones cost Rs 5 each. The old hen lays 3eggs per week      13
         and young ones 5 eggs per week, each egg being worth 30 paise. A hen costs Re 1 per week to feed. If a
         person has only Rs 80 tospend on the hens, how many of  each kind should be buy to get a profit of
         more than Rs 6 per week assuming that he can not house more than 20 hens?

Q.7      Maximize Z=$107x_1 + x_2 + 2x_3$                                      13
         Subjected to   $14x_1 + x_2 - 6x_3 + 3x_4 = 7$

$$16x_1 + \frac{1}{2}x_2 - 6x_3 \leq 5$$

         $3x_1 - x_2 - x_3 \leq 0$
         $x_1 x_2 x_3 x_4 \geq 0$

Q.8      It has been decided to shift grain from a warehouse to a factory in an open rectangular box of length      13
         $x_1$meters, width $x_2$ meters and height $x_3$meters. The bottom, sides and the ends of the box cost,
         respectively ▯80, ▯10 and ▯20/m$^2$. It costs ▯1 for each round trip of the box. Assuming that the box will
         have no salvage value, find the minimum cost of transporting 80m$^3$ of grains.

Q.9  a)  What do you understand by GA?                                      06
     b)  Explain your understanding about simulated annealing                                      07

Q.10     Write short notes (<u>any two</u>)                                      14
         a)  Dual phase method
         b)  Sensitivity analysis
         c)  Integer programming