Code No: I2101/R16

M. Tech. I Semester Regular/Supple Examinations, Jan/Feb-2018

OPTMIZATION TECHNIQUES & APPLICATIONS

Common to Thermal Engineering (21) and Advanced Manufacturing and Mechanical System Design (13)

Time: 3 Hours **Max. Marks: 60**

Answer any FIVE Questions
All Questions Carry Equal Marks

1. Find the value of x in the interval (0, 1) which minimizes the function $f = x(x - 1.5)$ to within ±0.05 by (a) the golden section method and (b) the Fibonacci method. 12

2. a Find the minimum of the function $f = (\lambda/\log \lambda)$ by the Cubic interpolation method (take the initial trial step length as 0.1). 6
   b Find the minimum of the function $f = \lambda/\log \lambda$ using Quasi Newton method. 6

3. a The following nonlinear equations are to be solved using an unconstrained optimization method: $2xy = 3$, $x^2 - y = 2$. Complete two one-dimensional minimization steps using the univariate method starting from the origin. 6
   b Perform two iterations of the Newton's method to minimize the function $f(x_1, x_2) = 100(x_2 - x_1^2)^2 + (1 - x_1)^2$ from the starting point $[-1.2\ 1.0]^T$. 6

4. Consider the two equations $7x^3 - 10x - y = 1$, $8y^3 - 11y + x = 1$. Formulate the problem as an unconstrained optimization problem and complete two steps of the Fletcher–Reeves method starting from the origin. 12

5. a Define the following terms: 6
   (i) Principle of optimality
   (ii) Boundary value problem

   b A student has to take examinations in three courses A, B and C. He has three days available for studying. He feels it would be best to devote a whole day to the study of same course, so that he may study a course for one day, two days, three days or not at all. His estimates of the grades he may get by studying are as follows: 6

Course/ Study days	A	B	C
0	0	1	0
1	1	1	1
2	1	3	3
3	3	4	3

How should he plan to study so that he maximizes the sum of his grades?

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6. A fertilizer company needs to supply 50 tons of fertilizer at the end of the first month, 70 tons at the end of second month, and 90 tons at the end of third month. The cost of producing x tons of fertilizer in any month is given by $(4500x + 20x^2)$. It can produce more fertilizer in any month and supply it in the next month. However, there is an inventory carrying cost of $400 per ton per month. Find the optimal level of production in each of the three periods and the total cost involved. 12

7. Solve the following problem using Gomory's cutting plane method: 12

Maximize $f = 6x_1 + 7x_2$

subject to $7x_1 + 6x_2 \leq 42$

$5x_1 + 9x_2 \leq 45$

$x_1 - x_2 \leq 4$

$x_i \geq 0$ and integer, $i = 1, 2$

8. a Explain briefly the following: 6

(i) Random variables

(ii) Probability density functions

b The width of a slot on a duralumin forging is normally distributed. The specification of the slot width is 0.900 ± 0.005. The parameters $\mu = 0.9$ and $\sigma = 0.003$ are known from past experience in production process. What is the percent of scrap forgings? 6

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