Code No: **RT42034B** **R13** **Set No. 1**

IV B.Tech II Semester Regular/Supplementary Examinations, April/May - 2019

ADVANCED OPTIMIZATION TECHNIQUES

(Mechanical Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B

Answer ALL sub questions from Part-A

Answer any THREE questions from Part-B

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PART–A *(22 Marks)*

1. a) Under what conditions can a polynomial in "n" variables be called a posynomial? Explain. [3]
   b) What do you mean by a gradient of a function? [4]
   c) What is the limitation of the linear extended penalty function? Explain. [3]
   d) How is the degree of difficulty defined for a constrained geometric programming problem? Explain. [4]
   e) Define the following terms: (i) Boundary value problem (ii) Separable function [4]
   f) What is a branch-and-bound method? Explain. [4]

PART–B *(3x16 = 48 Marks)*

2. Using Kuhn–Tucker conditions, find the value(s) of β for which the point $x_1^* = 1$, $x_2^* = 2$ will be optimal to the problem:

   Maximize $f(x_1,x_2) = 2x_1 + \beta x2$

   Subject to $g_1(x_1, x_2) = x_1^2 + x_2^2 - 5 \leq 0$

   $g_2(x_1, x_2) = x_1 - x_2 - 2 \leq 0$ [16]

3. Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$. Take the points defining the initial simplex as $X_1 = [4.0\ 4.0]^T$, $X_2 = [5.0\ 4.0]^T$, and $X_3 = [4.0\ 5.0]^T$ and $\alpha = 1.0$, $\beta = 0.5$, and $\gamma = 2.0$. For convergence, take the value of ε as 0.2. [16]

4. Construct the φ_k function, according to (a) interior and (b) exterior penalty function methods and plot its contours for the following problem: Maximize f = 2x subject to $2 \leq x \leq 10$. [16]

5. a) What are the applications of geometric programming? Explain. [8]
   b) Using arithmetic mean–geometric mean inequality, obtain a lower bound v for each function [$f(x) \geq v$, where v is a constant] in $f(x) = (x^{-2})/3 + 2/3\ x^{-3} + 4/3\ x^{3/2}$. [8]

6. Solve the following LP problem by dynamic programming:

   Maximize $f(x_1, x_2) = 10x_1 + 8x_2$

   Subject to $2x_1 + x_2 \leq 25$

   $3x_1 + 2x_2 \leq 45$

   $x_2 \leq 10$

   $x_1 \geq 0, x_2 \geq 0$. [16]

7. a) Discuss Bala's algorithm for Zero-one programming problem. [8]
   b) Convert the following integer programming problem into an equivalent zero–one programming problem:

Minimize $f = 6x_1 - x_2$

Subject to $3x_1 - x_2 \geq 4$

$2x_1 + x_2 \geq 3$

$-x_1 - x_2 \geq -3$

x_1, x_2 nonnegative integers. [8]