Total No. of printed pages = 3

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Roll No. of candidate | | | | | | | | | | |

2023

B.Tech. 6th Semester End-Term Examination

OPTIMIZATION TECHNIQUES IN ENGINEERING

(New Regulation (w.e.f. 2017 – 18) & New syllabus (w.e.f. 2018-19))

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer Question No. 1 and any *four* from the rest.

1. Choose the correct answer/Fill in the blank: (10)

(i) In an LPP, the coefficient of slack/surplus variables in the objective function are

(a) 0 (b) 1

(c) M (d) –M

(ii) Degeneracy in LPP occurs when ————————

(iii) If the constraints of an Linear Programming Problem has a constraint of ≥ type, the variable to be added to are variable to be added to are

(a) slack (b) surplus

(c) artificial (d) decision

(iv) Dynamic programming is concerned with the theory of ————————decision process.

(v) The determinant of hessian matrix of the function $x^2 - 2y^2 - 4y + 6$ at point (0, 0) is ————————

(a) 2 (b) –4

(c) 0 (d) 8

(vi) Hooke–Jeeves method consists of two major routines

(a) exploratory move and pattern move

(b) minor move and major move

(c) first order move and second order move

(d) direct move and indirect move

[Turn over

(vii) Fletcher-Reeves method uses

(a) steepest ascent direction (b) conjugate gradient direction

(c) steepest descent direction (d) pattern search direction

(viii) In a given system of m simultaneous linear equations in n unknowns (m < n) there will be

(a) n basic variables (b) m basic variables

(c) (n–m) basic variables (d) (n+m) basic variables

(ix) The full form of KKT in KKT conditions is ————————

(x) The Language multiplier method is used to solve

(a) unconstrained optimization (b) constrained optimization

(c) multi objective optimization (d) all of the above

2. (a) What are artificial variables, and when are they added to on LPP? Discuss a solution method involving artificial variables. (4)

(b) Solve the following LPP by Simplex method. (11)

Maximize $Z = 3x_1 + 2x_2$

Subject to $x_1 + x_2 \le 4$

$x_1 - x_2 \le 2$

$x_1, x_2 \ge 0$

3. (a) State the KKT conditions (3)

(b) Use Lagrange's multiplier method to solve the following : (12)

Optimize $z = x_1^2 + x_2^2 + x_3^2$

Subject to $x_1 + x_2 + 3x_3 = 2$

$5x_1 + 2x_2 + x_3 = 5$

$x_1, x_2, x_3 \ge 0$

4. Solve the following LPP by dynamic programming approach (15)

Maximize $z = 2x_1 + 5x_2$

Subject to $2x_1 + x_2 \le 43$

$2x_2 \le 46$

$x_1, x_2, \ge 0$

5. Perform three iterations of Golden section search to minimize the following function $F(x) = x^4 - 15x^3 + 72x^2 - 1135x$ (15)

The initial range is (1,15)

6. Apply Wolfe's method to solve the following : (15)

Maximize $z = 2x_1 + x_2 - x_1^2$

Subject to $2x_1 + 3x_2 \leq 6$

$2x_1 + x_2 \leq 4$

$x_1, x_2 \geq 0$

7. (a) Define and illustrate graphically the following terms associated with linear programming (4)

(i) Infeasible Solution

(ii) Unbounded Solution

(b) Explain briefly (4)

(i) The conjugate direction, and

(ii) The Descent direction

(c) The standard Weight of a special purpose brick is 5 Kg and it contains two basic ingredients B_1 and B_2. B_1 costs Rs.5 per Kg and B_2 costs Rs. 8 per Kg . Strength consideration states that the brick contains not more than 4 Kg of B_1 and minimum of 2Kg of B_2. Formulate the problem as LPP to minimize the cost of the brick, and solve it graphically. (7)