

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP2025)

CLASS: IMSc.
BRANCH: QEDS

SEMESTER: IV
SESSION: SP2025

SUBJECT: ED213 OPTIMIZATION TECHNIQUES

TIME: 02 Hours

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
5. All the notations used in the question paper have usual meanings.

CO BL

Q1 A small mine works two coal seams and produces three grades of coal. The upper seam costs Rs 10 lakhs per hour, yielding 1 ton of anthracite, 5 tons of best-quality coal, and 2 tons of ordinary coal per hour. The lower seam costs Rs 15 lakhs per hour, yielding 4 tons of anthracite, 6 tons of best-quality coal, and 1 ton of ordinary coal per hour. Given an order requiring a minimum of 8 tons of anthracite, 30 tons of best-quality coal, and 8 tons of ordinary coal, formulate a linear programming problem (LPP) and solve it graphically to find how many hours each seam should be worked to fulfill this order at the lowest cost? [3+2] CO1 1,2

Q2 Solve the following linear programming problem using an appropriate method.
 $\max 3x_1 + 5x_2 + 4x_3$; sub to $2x_1 + 3x_2 + 4x_3 = 8$, $3x_1 + 2x_2 + x_3 \leq 6$; $x_1, x_2, x_3 \geq 0$. [5] CO1 2

Q3 A company manufactures two products using two types of raw materials. The production constraints and profits are given below:

Product	Material 1 (kg)	Material 2 (kg)	Profit (per unit)
A	2	3	5
B	4	2	7
Availability	10 (kg)	12 (kg)	

[3+2] CO2 2

(a) Formulate the primal LPP to maximize profit. (b) Write its dual problem and interpret what the dual variables represent in the context of resource allocation.

Q4 An investment firm has 4 sources of funds (banks loans, venture capital, investor funds, corporate bonds) and wants to allocate money to 4 different investment options (stocks, bonds, real estate, and mutual funds). Cost Table (Interest Rate % or Required Return % Per Unit Investment) is given below. Consider the problem as transportation problem and find the initial basic feasible solution using Vogel approximation method to minimize the cost of capital (interest rates or required returns). [5] CO2 3

	Stocks	Bonds	Real Estate	Mutual Funds	Supply (in million dollars)
Bank loans	6	8	10	7	50
Venture capital	9	5	12	8	40
Investor funds	7	6	9	6	30
Corporate funds	10	7	8	5	60
Demands (Investment needs in million dollars)	40	30	50	35	

Q5 The initial transportation schedule for minimizing transportation cost of a problem is given as: $x_{12} = 10, x_{13} = 4, x_{21} = 1, x_{23} = 11, x_{31} = 5$. Check the optimality of the solution by modified distribution (MODI) method. If not optimal, use steppingstone method to find the optimal shipping schedule between the suppliers and consumers.

Consumer → Supplier ↓	A	B	C	Availability
I	6	8	4	14
II	4	9	3	12
III	1	2	6	5
Requirements	6	10	15	31

[5] CO2 3