Module 6 · Linear programming P16 · 6.0

SM pp. 422–455 (exercise 456–466). The exam asks LP as a **formulation** (+ the dual): J24 = J26 Q6(a) word for word, D25 Q6(a) with the dual; MCQs: corner-point Z, shadow price. Module 6 per paper: **J26-7 · D25-11 · J25-0 · D24-0 · J24-7 · D23-0** (J23-6).

1 · Decision variables
"Let x_1, x_2 … = units of …"

↓

2 · Objective
max contribution (price − variable costs; fixed costs out) or min cost

↓

3 · Constraints
one per resource; demand minimums (≥); ratios as equations; x ≥ 0

↓

4 · Dual (if asked)
max ↔ min; constraint limits become the objective; transpose the coefficients; ≤ ↔ ≥

WORKED PATTERN · SM ILLUSTRATION 6 (= D25 TYPE)

- Max Z = $6x_1 + 4x_2$; machining $x_1 + 2x_2 \le 720$, labour $2x_1 + x_2 \le 780$, Alpha $x_1 \le 320$. [SM 437–438]
- Simplex optimum: **280 Alpha, 220 Beta, Z = ₹2,560**; shadow prices ₹2/3 a machine hour, ₹8/3 a labour hour, 0 for Alpha's sales limit. [SM 440–441]

OUR WORKINGS (RECOMPUTED BY SCRIPT m06m07m09_patterns.py)

JUN'26 Q6(a) = JUN'24 Q6(a) (LEARN IT)

Max Z = 50A + 50B + 80C
Material I: 3A + 4B + 5C ≤ 5,000 · Material II: 5A + 3B + 5C ≤ 7,500
Labour (A = 2 × B = 3 × C in time; 3,000 A-units): A + B/2 + C/3 ≤ 3,000, i.e. **6A + 3B + 2C ≤ 18,000**
Minimum demand: A ≥ 600, B ≥ 650, C ≥ 500
Ratio 2 : 3 : 4: **3A = 2B** and **4B = 3C** (so C = 2A); A, B, C ≥ 0.

DEC'25 Q6(a) LM (FORMULATION + DUAL)

Contribution: Alfa 1,000 − 200 − 160 − 60 − 380 = **200**; Beta 900 − 200 − 80 − 120 − 350 = **150** (fixed ₹35 / hour left out).
Max Z = 200x + 150y; material 4x + 4y ≤ 960; labour 4x + 2y ≤ 800; painting x + 2y ≤ 400; x, y ≥ 0.
Dual: Min W = $960u_1 + 800u_2 + 400u_3$; $4u_1 + 4u_2 + u_3 \ge 200$; $4u_1 + 2u_2 + 2u_3 \ge 150$; u ≥ 0.
(Not asked: best corner (160, 80) → Z = ₹44,000.)

MCQs: Z at each corner, take the best (D25); a shadow price of ₹10 a labour hour = one more hour adds ₹10 to Z (D25).
Practise: J26, D25, J24 Q6(a), J23 Q8(a) · MQP / PTP Q6(a), postal Q7(i), Q11 · SM Illus. 1–12 (SM 427–455) · **ICMAI Practice Workbook Ch4 illus. 1–10** · MCQ bank Q69–Q76, Q254.