Module 14 · Forecasting P16 · 14.0

SM pp. 682–710 (exercise 711–716). **Q8(b) = a 7-mark forecasting sum in every paper since Dec'23** + a theory MCQ. Module 14 per paper: **J26-7 · D25-7 · J25-7 · D24-9 · J24-7 · D23-9**. Decembers: seasonal indices (D24, D25); Junes: exponential smoothing (J25, J26) — the trend line came in D23 and J24.

Paper	Q8(b)
Dec'23	least-squares trend, years 2 apart; forecast 2019 and 2025
Jun'24	least-squares trend, 7 years; forecast 2025
Dec'24	trend equation × seasonal index, four quarters (= SM Illus. 9, base year moved, indices III / IV swapped)
Jun'25	exponential smoothing 0.1, quarterly
Dec'25	**monthly seasonal indices by the trend ratio method**
Jun'26	exponential smoothing 0.1, monthly (= SM Illus. 10 template)

DEC'26

- Both recent Decembers had **seasonal indices** — expect trend × index, the trend ratio method, or a moving-average index.
- MCQs: exponential smoothing is not qualitative (D23); α near 1 weights recent demand (D24).

Formula	Notes	SM
y = a + bx; a = Σy ÷ n, b = Σxy ÷ Σx^2 with x centred (Σx = 0)	Even number of years: origin between the middle two, x unit = half a year (… −3, −1, 1, 3 …).	[SM 701]
Forecast = trend × seasonal index ÷ 100 (multiplicative)	Additive: trend + seasonal variation.	[SM 707]
Trend ratio: data ÷ trend × 100 → average per month / quarter → adjust to 1,200 / 400	Multiplicative data only.	[SM 702]
$\mathbf{u_t = u_{t-1} + \alpha (y_t - u_{t-1})}$	Error → α × error → add to the old forecast. Higher α discounts old data sooner.	[SM 707–708]

PROBLEMS BOX · Q8(b) (RECOMPUTED BY SCRIPT m14_patterns.py)

WORKED PATTERNS · SM ILLUSTRATIONS 6, 9, 10

- Illus. 6 (2014–2023): Σy 192, Σxy 177, Σx^2 330 → **y = 19.2 + 0.536x** (x unit 6 months); 2029 (x = 21) = **30.456**. [SM 701]
- Illus. 9: y = 25 + 0.6t; 2028 quarters t = 36–39 → trend 46.6, 47.2, 47.8, 48.4 × indices → **41.94, 44.84, 52.58, 50.82**. [SM 706–707]
- Illus. 10 (α 0.1): forecast 1,000, actual 900 → 990, then 992, 996, 994, 988, 990, **993**. [SM 708]

DEC'25 Q8(b) TREND RATIO (OUR WORKING)

Monthly averages 24.5, 29.667, 35.833 → trend a = 30 (mid-2023), b = 5.667 a year = 0.472 a month; trend for each month; actual ÷ trend × 100; average the three years; adjust to 1,200:

Jan 76.9	Feb 75.8	Mar 94.5	Apr 92.8	May 103.0	Jun 92.2
Jul 79.9	Aug 99.7	Sep 107.4	Oct 124.4	Nov 114.0	Dec 139.4

⚠ The SM explains the trend ratio method (SM 702) but has no worked example; ICMAI may fit the trend to all 36 months — state your method.

OUR WORKINGS · THE OTHER Q8(b)s

- **J26 My Fashion** (α 0.1, April forecast 200, actual 210): May **201**, June 202.3, July 203.77, Aug 206.19, Sept 209.07, Oct **210.67** (Nov 211.70), in '000.
- **J25 ship unloading** (forecast 195 for Q1 2023): … Q1 2025 = **198.60** tons.
- **D24 cumin**: t = 16–19 → trend 34.6, 35.2, 35.8, 36.4 × 0.90, 0.95, 1.05, 1.10 = **31.14, 33.44, 37.59, 40.04**.
- **J24 exports**: a 26, b = 53 ÷ 28 = 1.8929 → 2025 (x = 7) = **39.25**.
- **D23 zinc** (years 2 apart, x = −2…2): y = 42 + 0.4x → 2019 = **42.2**, 2025 = **43.4**.

PRACTISE THESE

D25, D24 Q8(b), J26, J25, J24, D23 Q8(b) · MQP / PTP Q8(b), postal Q10(a) · SM Illus. 4–10 (SM 697–708), Illus. 1–3 regression (SM 688–696) · MCQs D23 Q1(xv), D24 Q1(xiv) · **ICMAI Practice Workbook Ch9 illus. 1–10** · MCQ bank Q164–Q173, Q204, Q218.

Traps: centre x and state the origin and the unit; even years use half-year units; smoothing starts from the GIVEN first forecast; seasonal indices must total 1,200 (monthly) or 400 (quarterly).