INSTITUTE OF ACTUARIES OF INDIA

SP5 –Investment and Finance

November 2025 Examination

Indicative Solution

Introduction

The indicative solution has been written by the Examiners with the aim of helping candidates. The solutions given are only indicative. It is realized that there could be other points as valid answers and examiner have given credit for any alternative approach or interpretation which they consider to be reasonable.

Solution 1:

i) Herding

Herding occurs when investors imitate the actions of others rather than relying on their own information or analysis. It leads to correlated trading behaviour across market participants, often amplifying market trends.

- *Informational herding:* Investors assume others have superior information, so they follow the majority.
- *Reputational herding:* Fund managers mimic peers to avoid underperforming relative to benchmarks or competitors ("no one gets fired for buying IBM").
- *Institutional constraints:* Performance evaluation and career risk encourage

Key implication:

- Can cause asset price bubbles and crashes (e.g., tech bubble 1999–2000).
- Reduces market efficiency since prices reflect sentiment rather than fundamentals.
- From an asset allocation perspective, herding can distort correlations and reduce diversification benefits. (3)

ii) Cross-sectional momentum

Cross-sectional momentum refers to the empirical finding that assets that performed well relative to peers in the recent past tend to continue outperforming in the near future (typically over 3–12 months). Conversely, past losers continue to underperform.

- *Investor underreaction:* Investors are slow to incorporate new information, leading to continuation in price trends.
- *Herding and feedback trading:* Success attracts attention, causing further buying.
- *Behavioural biases:* Overconfidence and self-attribution reinforce trend-chasing behaviour.

Key Implication:

- Momentum is a behavioural anomaly inconsistent with Efficient Market Hypothesis (EMH).
- Quantitative managers exploit it through factor investing.
- From an ALM or long-term asset allocation perspective, momentum exposure introduces procyclicality, potentially exacerbating drawdowns in reversals. (3)

iii) The influence of mood in investment performance

Investor sentiment and mood — influenced by non-economic factors such as sunshine, sports results, temperature, or daylight hours — can affect risk appetite, trading activity, and pricing

- *Psychological channel:* Positive mood increases optimism, risk-taking, and overvaluation of risky assets; negative mood increases pessimism and risk aversion.
- *Attention and cognitive bias:* Good mood may reduce attention to detail and due diligence.
- *Physiological link:* Mood affects neurotransmitters linked to confidence and reward perception.

Key implication:

- Mood-driven sentiment can cause temporary mispricing and short-term volatility.
- Behavioural investors may overreact or underreact to news depending on prevailing sentiment.

- Asset allocators must recognize that sentiment cycles can affect timing decisions and liquidity provision opportunities. (3)

iv) Belief preservation

Belief preservation (or confirmation bias) refers to the human tendency to seek, interpret, and recall information that confirms existing beliefs, while discounting or ignoring contradictory evidence.

- Investors form an initial view (e.g., "Tech stocks will keep rising") and interpret new data in a way that sustains this belief.
- Related to cognitive dissonance avoidance: rejecting uncomfortable information that would require changing one's view.
- Leads to anchoring and slow belief updating even when evidence changes.

Key implication:

- Creates price inertia (slow reaction to bad news) or overreaction when reality finally contradicts beliefs.
- Reduces effectiveness of risk management and asset rebalancing since investors hesitate to exit wrong positions.
- In aggregate, belief preservation contributes to momentum and subsequent reversals, as market consensus shifts belatedly. (3)

[12 Marks]

Solution 2.

i) Theories of Finance and Asset Allocation

a) Modern Portfolio Theory (MPT)

1. Developed by Harry Markowitz; focuses on diversification and the efficient frontier.
2. Insurers use MPT to select asset mixes that maximize expected return for a given level of risk (measured by portfolio variance).
3. Encourages diversification across asset classes (bonds, equities, property) to reduce unsystematic risk.
4. However, insurers must modify this by including liability constraints (duration, currency) — making it *constrained optimization*.

b) Capital Asset Pricing Model (CAPM)

1. States that expected return on an asset depends on its systematic risk (β) relative to the market.
2. Informs insurers about the risk–return trade-off and pricing of risk when selecting asset classes.
3. Helps determine required returns on equity and other risky assets relative to the "risk-free" rate.
4. Useful for evaluating whether the insurer is being adequately compensated for taking additional equity or credit risk.

c) Efficient Market Hypothesis (EMH)

1. Suggests that markets reflect all available information; hence, active management rarely outperforms passive strategies on a risk-adjusted basis.

2. For insurers: implies that low-cost, passive indexing or systematic factor strategies may be more efficient than expensive active management.
3. However, insurers might still seek alpha in less efficient markets (e.g., private debt, real estate).

d) Liability-Driven Investment (LDI) Framework

1. Extends traditional finance theory by aligning the investment portfolio with liability characteristics.
2. Focuses on duration matching, cash-flow matching, and hedging interest rate or inflation risks embedded in liabilities.
3. Helps ensure the insurer's assets move in value consistent with its obligations — limiting solvency volatility.
4. Blends risk-return optimization (MPT) with liability constraints (ALM focus).

(8)

ii) Real-World Deviations from Theoretical Portfolios:

1. *Regulatory capital constraints:* RBC frameworks impose capital charges by asset type — high for equities or alternatives, lower for government bonds — skewing asset mix away from theoretical optimum.
2. *Accounting rules:* Mark-to-market volatility may discourage holding volatile but high-return assets.
3. *Liquidity requirements:* Need for liquidity to pay claims and surrenders limits illiquid investments.
4. *Behavioural biases:* Management may display loss aversion, leading to underinvestment in equities despite long horizons.
5. *Market frictions:* Transaction costs, taxes, and illiquidity premiums distort the efficient frontier.
6. *Information inefficiency in practice:* Allows selective active management contrary to pure EMH assumption.
7. *Internal Investment constraints:* Some asset classes or stocks may not be allowed due to internal requirements.

(6)

iii) Balancing Return-Seeking and Liability-Matching Assets

Portfolio Segment	Objective	Example Assets	Link to Theory
Return-Seeking Portfolio	Enhance long-term return above guaranteed rates	Equities, real estate, private credit	Guided by MPT, CAPM; adjusted for risk premium and diversification
Liability-Matching Portfolio	Hedge interest rate, duration, and inflation risk of liabilities	Long-term government/corporate bonds, swaps	Guided by LDI; reflects duration and cash flow matching principles
Overall Portfolio	Achieve efficient risk-adjusted return while preserving solvency	Balanced mix optimized under capital constraints	MPT + LDI under real-world constraints

(max 6 marks)

Key point to note:

1. The theory of finance provides a framework for optimal asset allocation, but insurers must modify these models to account for liability profiles, regulatory capital, internal constraints and behavioural realities.

[20 Marks]

Solution 3:

i) **Compute portfolio total return** from component weights and portfolio returns:

Equities contribution = $0.45 \times 0.090 = 0.04050$ (i.e. 4.050%)
Gov. bonds contribution = $0.30 \times 0.040 = 0.01200$ (i.e. 1.200%)
Corp. bonds contribution = $0.15 \times 0.060 = 0.00900$ (i.e. 0.900%)
Property contribution = $0.10 \times 0.070 = 0.00700$ (i.e. 0.700%)

Sum these: $0.04050 + 0.01200 + 0.00900 + 0.00700 = 0.06850$. So computed portfolio return = 6.85% (0.0685).

Compute benchmark total return from benchmark weights and benchmark returns:

Equities bench contribution = $0.40 \times 0.080 = 0.03200$(3.200%)
Gov. bonds bench contribution = $0.35 \times 0.045 = 0.01575$(1.575%)
Corp. bonds bench contribution = $0.15 \times 0.055 = 0.00825$(0.825%)
Property bench contribution = $0.10 \times 0.060 = 0.00600$(0.600%)
Sum: $0.03200 + 0.01575 + 0.00825 + 0.00600 = 0.06200$.

So computed benchmark return = 6.20% (0.0620).

Total excess return (portfolio − benchmark) = 6.85% − 6.20% = 0.65 percentage points or pp

Recall the formulas (in decimals):

Allocation effect (A_i) = $(w_{p,i} - w_{b,i}) \times (R_{b,i} - R_b^{total})$.
Selection effect (S_i) = $w_{b,i} \times (R_{p,i} - R_{b,i})$.
Interaction effect (I_i) = $(w_{p,i} - w_{b,i}) \times (R_{p,i} - R_{b,i})$.

We use R_b^{total} =benchmark total return = 0.0620.

Calculate step by step for each asset.

Equities:

$w_p - w_b = 0.45 - 0.40 = 0.05$.
$R_{b,i} - R_b^{total} = 0.080 - 0.062 = 0.018$.
Allocation: $A_{eq} = 0.05 \times 0.018 = 0.00090$. (0.090 percentage points)
Selection: $S_{eq} = w_b \times (R_p - R_b) = 0.40 \times (0.090 - 0.080) = 0.40 \times 0.010 = 0.00400$. (0.400 pp)
Interaction: $I_{eq} = 0.05 \times 0.010 = 0.00050$. (0.050 pp)

Government bonds:

$w_p - w_b = 0.30 - 0.35 = -0.05$.
$R_{b,i} - R_b^{total} = 0.045 - 0.062 = -0.017$.
Allocation: $A_{gov} = -0.05 \times (-0.017) = +0.00085$. (0.085 pp)
Selection: $S_{gov} = 0.35 \times (0.040 - 0.045) = 0.35 \times (-0.005) = -0.00175$. (-0.175 pp)
Interaction: $I_{gov} = (-0.05) \times (-0.005) = 0.00025$. (0.025 pp)

Corporate bonds:

$w_p - w_b = 0.15 - 0.15 = 0.00$.
Allocation: $A_{corp} = 0.00 \times (0.055 - 0.062) = 0.00$. (0.000 pp)
Selection: $S_{corp} = 0.15 \times (0.060 - 0.055) = 0.15 \times 0.005 = 0.00075$. (0.075 pp)
Interaction: $I_{corp} = 0.00 \times 0.005 = 0.00$. (0.000 pp)

Property:

$w_p - w_b = 0.10 - 0.10 = 0.00$.
Allocation: $A_{prop} = 0.00 \times (0.060 - 0.062) = 0.00$. (0.000 pp)
Selection: $S_{prop} = 0.10 \times (0.070 - 0.060) = 0.10 \times 0.010 = 0.00100$. (0.100 pp)
Interaction: $I_{prop} = 0.00 \times 0.010 = 0.00$. (0.000 pp)
Overall summary of calculations:

Asset	Alloc (pp)	Sel (pp)	Int (pp)	Total contribution (pp)
Equities	0.00090 = 0.090 pp	0.00400 = 0.400 pp	0.00050 = 0.050 pp	0.540 pp
Gov. bonds	0.00085 = 0.085 pp	-0.00175 = -0.175 pp	0.00025 = 0.025 pp	-0.065 pp
Corp. bonds	0.00000 = 0.000 pp	0.00075 = 0.075 pp	0.00000 = 0.000 pp	0.075 pp
Property	0.00000 = 0.000 pp	0.00100 = 0.100 pp	0.00000 = 0.000 pp	0.100 pp
Totals	0.00175 = 0.175 pp	0.00400 = 0.400 pp	0.00075 = 0.075 pp	**0.00650 = 0.650 pp**

Cross check:

Allocation total = $0.00090 + 0.00085 + 0 + 0 = 0.00175$ = 0.175 pp.
Selection total = $0.00400 - 0.00175 + 0.00075 + 0.00100 = 0.00400$→ 0.400 pp.
Interaction total = $0.00050 + 0.00025 + 0 + 0 = 0.00075$= 0.075 pp.
Grand total = $0.00175 + 0.004\,d00 + 0.00075 = 0.00650$ = 0.650 pp, which equals the computed excess return (6.85% − 6.20% = 0.65 pp).

Monetary value added:

Allocation total = 0.175 pp = 0.00175 (decimal). Monetary = $0.00175 \times 1{,}000$= INR1.75cr.
Selection total = 0.400 pp = 0.00400. Monetary = $0.00400 \times 1{,}000$= INR4.00 cr.
Interaction total = 0.075 pp = 0.00075. Monetary = $0.00075 \times 1{,}000$= INR0.75 cr**.**
Check: Sum monetary = $1.75 + 4.00 + 0.75 = \text{INR}6.50$cr, which equals the total excess return of 0.65% × INR1,000cr = INR6.50cr.

(max 12 marks)

ii)

- **Equities:** Manager overweight (+5 pp) into equities and stock selection produced higher returns than benchmark (portfolio equity return 9.0% vs benchmark 8.0%). This suggests active security selection + tactical overweight in equities — possibly sector/country tilt or stock picking. The big positive selection effect (+0.400 pp) is consistent with manager skill or favourable active bets in equity markets.
- **Government bonds:** Manager underweighted government bonds (−5 pp). However, government bonds outperformed the overall benchmark (4.5% vs benchmark total 6.2%? — here note government was relatively strong vs others). The negative selection effect (−0.175 pp) indicates poor security selection in gov bonds (portfolio gov return 4.0% < bench 4.5%) and the underweight hurt performance. Possible reasons: manager favored higher-yielding corporates/real assets at the time (seeking yield), or mis-timed duration/credit bets.
- **Corporate bonds & property:** Small, positive selection effects suggest modest skill or favourable market exposure in these asset classes.
- **Overall:** The structure — large selection in equities and small positive interaction — points to some manager skill on equities. But an examiner looks for caution: one year of outperformance could be due to market conditions (e.g., concentrated rally in small number of stocks the manager held) rather than persistent skill. To argue skill confidently, one should see consistent multi-period selection alpha and explain the sources (sector bets, stock-picking process, information edge).

(max 4 marks)

iii)

- **Performance fees:** Use **multi-year smoothing**: attribute annual excess to selection vs allocation; pay manager performance fees primarily on *selection* (security-picking) rather than allocation if allocation is committee-level mandate. In our example, equities selection = INR4.0cr. — candidate for manager bonus if consistent across years. However, fees should be subject to high-water marks and multi-year evaluation (e.g., averaging 3–5 years) to avoid rewarding luck.
- **Risk-adjusted measurement:** Over and above monetary value added, risk-adjusted returns (e.g., information ratio, alpha per unit of active risk) should be considered before awarding fees; this prevents rewarding high active risk that either consumed capital (through higher RBC) or exposed the insurer to downside.
- **Fairness across time horizons:** Life insurers should consider the liability horizon**:** short-term manager outperformance might be offset by long-term ALM mismatches. Therefore, tie bonus accruals to long-horizon performance and to adherence to risk budgets (e.g., penalties if tracking error limits breached).
- **Governance:** Use attribution to allocate the bonus pool between internal teams (asset allocation, passive management, active security selection) fairly — e.g., allocate a slice of the pool to the allocation committee if allocation contributed materially (INR1.75cr here) and to the active managers for selection (INR 4.0cr.)

(max 4 marks)
[20 Marks]

Solution 4:

i) Key reasons include:

1. *Risk Management*: ESG factors highlight non-financial risks (e.g., climate change, labour practices, corporate governance failures) that can lead to financial losses or asset devaluation if ignored.
2. *Long-Term Sustainability*: Integrating ESG helps identify firms with sustainable business models, supporting stable, long-term investment performance — critical for institutions like pension funds or insurers.
3. *Regulatory and Fiduciary Duties:* Regulators increasingly expect investors (especially insurers and trustees) to consider ESG risks under the Prudent Person Principle and fiduciary responsibility frameworks.
4. *Reputation and Stakeholder Expectations*: Investors are under pressure from policyholders, shareholders, and the public to act responsibly — neglecting ESG can harm reputation and stakeholder trust.
5. *Opportunity Identification:* ESG analysis can also uncover new investment opportunities in sectors such as renewable energy, sustainable infrastructure, and green finance.

(max 3 marks)

ii) Sharpe Ratio and Suitability

a) Sharpe Ratio (including ESG adjustment)

$$\text{Sharpe ratio} = \frac{E(R) - R_f}{\sigma}$$

Portfolio	$E(R)$	R_f	σ	Sharpe ratio
A	7.0%	2.0%	10%	(7.0 – 2.0)/10 = 0.50
B	6.5%	2.0%	8%	(6.5 – 2.0)/8 = 0.5625

Portfolio B has a higher risk-adjusted return.

ESG Adjusted Sharpe ratio (One possible approach)

- ESG Score (normalized)= ESG Rating/5.Then incorporate this as a weighting factor on the Sharpe ratio.
- Normalized ESG Score :
  - Portfolio A : 2/5 = 0.4; Portfolio B : 4/5 = 0.8
- ESG-adjusted Sharpe = Sharpe × Normalized ESG Score
  - Portfolio A = 0.4 * 0.5 = 0.2
  - Portfolio B = 0.5625 * 0.8 = 0.45

Portfolio B has a higher ESG adjusted cum risk adjusted return.

(max 3 marks)

b) Suitability for the insurer:

Financially:

1. Portfolio B has a slightly lower expected return (6.5% vs 7.0%) but superior risk-adjusted performance (Sharpe 0.56 vs 0.50).

2. This aligns with a moderate risk appetite, providing smoother returns and less downside risk.

ESG Profile:

1. Portfolio B has lower carbon intensity and a higher ESG rating, reducing long-term transition and reputational risks.
2. This aligns with regulatory expectations (e.g., UK Climate Risk Disclosure, TCFD) and the insurer's fiduciary duty.

Overall:

Portfolio B is more suitable — it offers a better balance between financial efficiency and sustainability objectives, consistent with prudent person and ESG integration principles.

(max 3 marks)

iii) Mandate is the term often used to refer to the authority given by the owner of investments to the investment manager whom they employ to manage their investments. Fund managers may be engaged to invest:

- in one particular asset class, for example US fixed-interest bonds (a specialist mandate basis)
- across a range of asset classes with certain restrictions (a balanced or multi-asset approach).

(max 2 marks)

iv) Advantages and disadvantages of different type of mandates.

- <u>Specialized (Single-Asset) Mandates</u>

Advantages:

1. *Specialist Expertise:* Managers can develop deep knowledge and analytical skill within one asset class, potentially improving security selection and performance.
2. *Clear Performance Measurement:* Easier to benchmark each manager against a well-defined index (e.g., FTSE All-Share for equities, iBoxx for bonds).
3. *Diversification of Manager Risk:* Using multiple specialist managers spreads operational and style risk — one underperforming manager has limited impact on the total fund.
4. *Transparency and Accountability:* Each manager's contribution to total return is identifiable, aiding performance attribution.

Disadvantages:

1. *Coordination Challenges:* No single manager has responsibility for total-portfolio risk; exposures may overlap (e.g., equity and credit risk) or leave unintended gaps.
2. *Higher Costs:* Multiple mandates mean more management fees, reporting, and monitoring overheads.
3. *Tactical Inflexibility*: Asset allocation decisions sit with the sponsor or investment committee, slowing response to market conditions.
4. *Governance Burden:* The client must maintain strong oversight and rebalancing discipline across managers.

- <u>Multi-Asset (Overall) Mandates</u>

Advantages:

1. *Integrated Asset Allocation:* The manager can dynamically adjust weights between asset classes, improving responsiveness to changing markets.
2. *Simpler Governance:* One relationship to manage; easier reporting and oversight.
3. *Potentially Lower Fees:* Economies of scale and reduced duplication of work.

Disadvantages:

1. *Reduced Specialization:* Manager may lack deep expertise in every asset class, possibly leading to weaker relative performance.
2. *Opaque Attribution:* Harder to separate whether poor results arise from asset allocation or security selection.
3. *Concentration of Manager Risk:* Over-reliance on one manager increases exposure to operational or strategic misjudgement. (max 7 marks)

[18 Marks]

Solution 5:

i) Key ALM risks:

1. *Interest rate / reinvestment risk:*
    a. Long-term guarantees at 3.5% vs. current asset mix: if rates rise sharply, new reinvestment yields increase (good for reinvestment), but existing bond prices fall causing immediate economic losses (market value) and potential capital strain via reduced eligible own funds.
2. *Mismatch / duration risk:*
    a. Liability average duration ≈ 25 years; asset duration (weighted) ≈ 0.5×10 + 0.3×(equity ≈ 0?) + 0.15×(real estate ≈ long) — rough gap likely positive (assets shorter than liabilities). This gap exposes the firm to PV changes when rates move.
3. *Convexity / non-linearity:*
    a. Equities and real estate have complex risk-return profiles; hedging with bonds addresses linear rate risk but not convexity differences.
4. *Equity risk / market risk:*
    a. Participating bonuses linked to investment returns -> equity falls reduce distributable surplus, may raise lapses and pressure guarantees.
5. *Policyholder optionality / behavioural risk:*
    a. Surrender after 10 years: in rising-rate environment surrender incidence may change (e.g., lapse if alternative yields attractive) — optionality affects liability cashflows and durations.
6. *Credit / liquidity risk:*
    a. Rising rates + equity volatility may reduce market liquidity or depress bond prices; real estate is illiquid and slow to revalue.
7. *Regulatory capital / solvency implications:*
    a. Solvency ratio near threshold (165%) means market shocks (interest fall or equity drop) could push ratio below required; regulatory measures (RBC) sensitive to asset volatility and interest changes.
8. *Model & basis risk:*
    a. Proxy hedges, assumptions on longevity/morbidity/lapse, bonus smoothing rules introduce basis risk.

(max 5 marks)

ii) Comprehensive ALM strategy

Objectives and constraints:

1. Preserve solvency > regulatory minimum (buffer); manage earnings volatility; protect ability to pay bonuses and guarantees.
2. Constraints: liquidity needs (surrenders), accounting (local GAAP/IFRS), regulatory eligibility of assets, transaction costs.

Duration & convexity management:

1. Target: close the effective duration gap between assets and liabilities while keeping capital buffer.
2. Tactics:
    a. Increase allocation to long-duration fixed income (inflate from 50% → higher if feasible) by buying long-duration investment-grade gov/corp bonds, or extend duration by purchasing high-quality callable/non-callable long bonds.
    b. Use interest rate swaps (receive floating, pay fixed) to synthetically extend asset duration (pay fixed to gain long-duration exposure without buying long bonds).
    c. Monitor convexity: if liabilities have higher convexity than the asset mix, consider using long-dated options or bullet bonds to better match convexity.

Use of derivatives:

1. Interest rate swaps: primary tool to manage duration quickly and capital-efficiently. Enter long-dated pay-fixed swaps to increase duration.
2. Swaptions: buy payer swaptions (pay fixed) as protection if rates fall (protects against falling rates that increase liability PV). Alternatively, write (sell) receiver swaptions if confident rates will rise — but selling optionality is risky given near-threshold solvency.
3. Inflation swaps / caps/floors: if liabilities have inflation linkage or real estate yields are affected.
4. Equity hedges: use index put options or collars to limit downside (10–15% risk). Important: choose economically effective strike/tenor to limit cost and not eliminate upside entirely — collars funded by selling calls or reducing equity allocation.
5. Total return swaps (TRS) / variance swaps: to synthetically reduce equity beta without selling illiquid holdings.
6. Lapse hedges: structured derivatives or reinsurance can hedge policyholder behaviour risk (e.g., reinsurance of surrender spikes).

Asset allocation shifts & liquidity

1. Reduce near-term equity exposure (from 30% to a lower tactical weight) to protect solvency (gradual de-risking to avoid crystallizing losses).
2. Increase high-quality long-dated bonds or synthetic equivalents (swaps) to match liability duration.
3. Hold a liquidity buffer (increase cash/short-term from 5% to ~7–10%) to meet surrender and collateral needs for derivatives.
4. Real estate management: revalue and consider rotating into higher-yielding but liquid credit (if capital efficient) unless real estate's cashflows match long-term liabilities.

Dynamic rebalancing / tactical rules

1. Trigger-based rebalancing: define triggers (PV01 movement, solvency ratio hitting thresholds, equity drawdown > X%) that cause hedging or rebalancing actions.
2. Gradual hedging program: time-limited overlay that enters swaps/puts progressively to avoid market timing risk.
3. Liquidity management ladder: match cash flows to surrender windows (especially post-10 years) — keep short-duration instruments to cover expected surrenders.

Participating bonus management

1. Smoothing mechanism: define a transparent bonus smoothing policy that uses an "available surplus" buffer; in volatile periods, reduce discretionary bonuses rather than guaranteed rate.
2. Explicit management of declared bonuses: link bonus increases to three-year rolling investment performance; during high volatility, restrict bonus distributions to preserve capital.
3. Communication: clear policyholder communications to reduce lapse risk from perceived reductions in returns.
4. Profit sharing reserve: maintain targeted reserve to absorb temporary equity-induced earnings volatility.

Capital & reinsurance levers

1. Reinsurance: consider reinsurance on mortality/longevity or even surrender risk to reduce capital strain.
2. Hybrid capital or contingency capital: issue subordinated debt or triggers for recapitalization if solvency falls.
3. Regulatory engagement: early consultations with regulator for planned de-risking actions.

(max 14 marks)

iii) Impact on profitability and solvency over 5–10 years (evaluation / scenario analysis)

1. Baseline intuition:
    a. Hedging rate risk with swaps and buying long bonds increases market value sensitivity in the short run (swap collateral), but reduces PV volatility of liabilities — improves Solvency II SCR in rate stress tests.
    b. Equity de-risking reduces expected long-term return (lower profit participation upside) but reduces volatility and immediate solvency risk.
2. Scenario outcomes (qualitative ranges):
    a. Sharp rates rise (as expected in next 2 years):
        i. Holding more long bonds - mark-to-market losses on existing bond holdings (if bought earlier) but newly reinvested cash earns higher yields improving future asset cashflows.
        ii. Duration-matching via swaps reduces net PV sensitivity — solvency ratio may fall slightly in the short term due to market losses but recovers as higher reinvestment rates materialize.
    b. Equity 10–15% downside near-term:
        i. If equity puts or collar in place - limited capital hit; without hedge - distributable surplus declines and solvency ratio drops (potentially below regulatory threshold).
        ii. Hedging costs reduce near-term profits (option premia), but protect solvency and reduce risk of forced asset sales at depressed prices.
3. Balance of profitability vs solvency:

a. Profitability: expected reduced upside from equities and cost of derivatives lower long-run ROE marginally (trade-off). However, avoiding solvency breach avoids forced deleveraging, which would be much worse for profitability.
b. Solvency ratio: a conservative overlay with swaps and equity hedges and bonus discipline should reduce probability of fall eacing below regulatory threshold. Quantitatively, a well-structured program could reduce downside solvency volatility by a material margin (e.g., reduce Tail-SCR percentiles), but exact % improvement depends on hedge ratios and market moves.

4. Continuous monitoring: run stochastic projection (ALM model) with 3 scenarios (up-rate, down-rate, equity stressed) and report solvency ratio paths at 1, 3, 5, 10 years. Use dynamic hedging costs and bonus smoothing rules. (max 6 marks)

iv) Limitations of traditional ALM techniques (critical assessment)

1. *Non-parallel yield curve shifts:* Duration matching assumes parallel shifts; in practice, steepening/flattening changes may produce hedging residuals. Long-duration swaptions can help but are costly.
2. *Convexity mismatch:* Duration hedges address first-order sensitivity (DV01) but not convexity — liabilities with embedded options (surrenders/bonuses) have non-linear PV responses.
3. *Policyholder behaviour unpredictability:* Lapses and surrenders are path-dependent and correlate with economic variables (e.g., lapses rise when alternative returns rise). Traditional static ALM cannot capture this without dynamic behavioural models.
4. *Model risk / parameter uncertainty:* Mis-estimating volatility, correlation (rates vs equities), or future mean reversion leads to suboptimal hedges.
5. *Liquidity and transaction costs:* Rebalancing and entering long-dated derivatives have costs and collateral requirements that may worsen during stress (margin calls).
6. *Accounting/regulatory differences:* Hedge accounting limitations and regulatory recognition rules can make economically sound hedges inefficient from a capital/accounting viewpoint.
7. *Concentration & counterparty risk:* Synthetic hedges concentrate exposure with counterparties — counterparty default risk matters under stress.
8. *Operational and governance limits:* Implementing dynamic ALM requires robust systems, governance, and skilled staff; mis-execution can exacerbate risks.

(max 5 marks)

[30 Marks]

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