

INSTITUTE OF ACTUARIES OF INDIA

Subject SP4 – Pensions and Other Benefits

May 2026 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 examiners have given credit for any alternative approach or interpretation which they consider to be reasonable.

Solution 1:**i) Stakeholders and Roles****1. Employer (ABC Manufacturing Ltd.)**

- DB Scheme :
 - Responsible for funding past service liabilities, managing deficit risk, and ensuring scheme remains solvent despite no new entrants.
- DC Scheme
 - Designs pension structure
 - Decides contribution rates and funding policy

2. Employees / Members

- DB Scheme
 - Existing members retain accrued benefits in close DB scheme; bear limited risk (mainly employer default risk)
- DC Scheme
 - Contribute to DC scheme
 - Bear investment risk in DC and receive retirement benefits

3. Trustees / Pension Committee

- DB Scheme
 - Manage scheme assets prudently, ensure benefits are paid, and act in best interest of members while scheme runs off
 - Oversee governance of pension fund
- DC Scheme
 - Ensure investments comply with regulations and fiduciary duties

4. Regulator

- DB Scheme
 - Ensures funding adequacy , member protection, and compliance with pension regulations
- DC Scheme
 - Supervises compliance with pension laws
 - Protects member interests and ensures prudential standards

[4]**ii) Risk Comparison – DB vs DC****1. Investment Risk****Under DB**

- Employer bears investment underperformance risk
- Poor returns increase funding deficit

Under DC

- Members bear investment volatility directly

Impact on Employee A (58 years)

- Limited time to recover from market downturn
- Sequence-of-return risk close to retirement is high
- Likely to switch to conservative assets

Impact on Employee B (28 years)

- Long investment horizon allows recovery
- Can take higher equity exposure
- Benefits from compounding over time

2. Longevity Risk**Under DB**

- Employer bears risk of members living longer than expected
- Actuarial assumptions affect contribution volatility

Under DC

- Member bears risk of outliving accumulated corpus

Impact on Employee A

- Majority DB benefits provide lifetime income security
- Small DC portion still exposed to drawdown risk
- Shorter expected remaining lifetime reduces uncertainty

Impact on Employee B

- Entire retirement depends on DC accumulation
- Must self-manage drawdown phase
- Greater uncertainty due to longer post-retirement horizon

3. Inflation Risk**Under DB**

- If benefits indexed, employer bears inflation cost
- If not indexed, pension purchasing power erodes

Under DC

- Investment returns must exceed inflation

Impact on Employee A

- Near retirement, limited ability to adjust savings
- High inflation just before retirement reduces real corpus
- Less time for wage growth to offset inflation

Impact on Employee B

- Long-term exposure to salary and price inflation
- Needs equity exposure for inflation hedge
- Inflation uncertainty over 30+ years significant

[9]

iii) Evaluation of DC Design & Recommendations

A. Weaknesses

Voluntary Contributions

- Behavioural inertia leads to low participation
- Lower-income employees may not contribute
- Inadequate retirement savings accumulation

Matching Only Voluntary Contributions

- Benefits higher-paid employees more
- May increase inequality in retirement outcomes

Partial Withdrawals

- Reduces long-term compounding
- Funds used for short-term consumption
- Leads to insufficient retirement corpus

Lump Sum at Retirement

- Risk of rapid depletion
- No protection against longevity risk
- Members may lack financial literacy

Investment Risk

- No default investment strategy
- Members may choose inappropriate asset allocation

B. Recommended Improvements

Auto-Enrolment

- Increases participation rates
- Uses behavioural nudging

Mandatory Minimum Contributions

- Ensures baseline retirement savings
- Protects lower-income workers

Auto-Escalation of Contributions

- Gradually increases savings rate
- Links increases to salary growth

Lifecycle / Default Funds

- Reduces equity exposure near retirement
- Protects older members from market shocks

Restriction on Early Withdrawals

- Preserves retirement adequacy
- Maintains long-term compounding

Partial Annuitisation at Retirement

- Provides lifetime income stream
- Reduces longevity risk exposure

Justifications (Cost vs Security Balance)

- Reduces employer DB funding volatility
- Provides predictable contribution cost
- Enhances member retirement adequacy

[12]
[25 Marks]

Solution 2:**i) Funding Objective – Key Factors**

- Strength of employer covenant
- Maturity profile of scheme
- Scheme funding level
- Risk appetite of trustees and sponsor
- Volatility of investment returns
- Interest rate sensitivity of liabilities
- Regulatory requirements
- Cash flow profile of benefits
- Time horizon to long-term target
- Contingency planning arrangements

[3]

ii) Application to Given Scheme**A. Investment Strategy**

- High pensioner proportion implies mature scheme
- Mature schemes need lower volatility
- Equity-heavy portfolio increases funding risk
- Bond allocation better matches liability duration
- Consider gradual de-risking rather than immediate switch
- Liability driven approach may reduce interest rate risk
- Reduced return-seeking assets lowers upside potential
- Asset allocation should reflect weakening covenant
- Comply with prudential investment norms (e.g., limits on equities, concentration risk)

B. Funding Contributions

- 92% funding indicates deficit
- Employer may need to increase or front-load contributions due to high pension outgo.
- Limited contribution inflow from active members (only 10%)
- Lower expected returns increase required contributions
- Weak covenant reduces flexibility in recovery plan
- Shorter recovery plan increases affordability strain
- Longer recovery plan increases member risk
- Need balance between prudence and affordability
- Contingent assets could reduce cash contributions
- Compliance with minimum funding standards

C. Risk Management

- Mature profile increases sequencing risk.... Sequencing risk is the risk that the timing of investment returns (good or bad years) adversely impacts the scheme's ability to meet benefit payments — especially when cashflows are negative
- Use **hedging (interest rate & inflation risk)**
- Cash flow negative scheme needs liquidity planning
- Strong dependence on employer support
- Monitoring covenant regularly is essential
- Stress testing funding under downside scenarios
- Journey plan provides structured de-risking framework
- Longevity risk more material with 65% pensioners
- Buy-in/buyout feasibility may be long-term objective

[8]

iii) Balancing Competing Objectives

A. Member Security

- De-risking reduces probability of large deficit
- Lower volatility improves benefit security
- Weak covenant increases need for prudence
- Mature scheme has limited time to recover losses
- Members rely on trustees for protection

B. Sponsor Affordability

- Immediate de-risking may increase contributions
- Higher bond allocation lowers expected returns
- Business investment may support covenant strength
- Excessive contributions could weaken employer further
- Sustainable recovery plan improves long-term support

C. Strategic Considerations

- Closed scheme suggests endgame planning appropriate
- Self-sufficiency target reduces reliance on covenant
- Phased de-risking reduces market timing risk
- Trigger-based framework balances growth and prudence
- Contingent security (e.g., asset charge) may offset risk
- Integrated risk management approach required
- Regular covenant monitoring essential
- Clear long-term journey plan improves governance

D. Recommended Way Forward

- Adopt formal journey plan toward self-sufficiency
- Implement gradual de-risking aligned with funding improvements
- Use trigger-based equity reductions
- Agree balanced recovery plan reflecting covenant capacity
- Explore contingent assets to support member security

[12]
[23 Marks]

Solution 3:

i) Objectives & Features of Projection Model

Objectives

- Project future benefit cashflows
- Project future contribution income
- Assess funding level evolution over time
- Determine stable contribution rates
- Support long-term funding strategy decisions

Key Features

- Membership projections (retirement, withdrawal, death)
- Salary escalation modelling
- Benefit accrual and payment projection
- Asset roll-forward using assumed returns
- Explicit economic and demographic assumptions

[5]

ii) Aggregated Deterministic Model – Limitations & Enhancements

A. Limitations of Aggregated Deterministic Model

- Aggregation masks age/service distribution differences
- Fails to capture high-salary skew
- Uniform salary growth ignores promotional scales
- Ignores variability across member groups
- Assumes single investment return path
- Does not capture volatility explicitly
- Ignores interaction between inflation and salary growth
- May understate longevity improvements at older ages

B. Model Enhancements

- Use member-level or grouped-by-age modelling
- Apply service-related salary progression scales
- Link salary growth explicitly to inflation assumption
- Model liabilities by duration band
- Introduce scenario-testing functionality
- Allow contribution adjustments dynamically
- Incorporate mortality improvement assumptions

- Ensure internal consistency across assumptions

C. Likely Impact on Outputs

- More granular modelling may increase or reduce the liabilities
- Recognition of salary skew may increase or reduce service cost
- Explicit inter-dependencies may increase or reduce volatility
- Improved longevity modelling may increase pensioner liabilities
- Contributions may need to increase or reduce
- Funding path may appear less stable
- Better understanding of key risk drivers
- Supports more informed trustee decision-making

[10]

iii) Deterministic vs Stochastic Modelling & Contribution Setting

A. Limitations of Deterministic Modelling

- Uses single best estimate scenario
- Ignores variability of returns
- Does not show probability of deficit
- Underestimates tail risks
- Ignores path dependency effects
- May give false sense of precision

B. Advantages of Stochastic Modelling

- Generates distribution of funding outcomes
- Quantifies probability of achieving funding target
- Captures inflation and interest rate volatility
- Models correlation between economic variables
- Useful for setting risk appetite
- Supports integrated risk management

C. Limitations of Stochastic Modelling

- You need valid and tested distribution/statistical model for all the assumptions used in the valuation and errors may amplify, if modelled incorrectly
- Results sensitive to calibration assumptions
- Complex and harder for trustees to interpret
- Computationally intensive
- May obscure key drivers if poorly communicated

D. Recommended Sensitivity & Stress Framework (India Context)

- ± 200 bps discount rate stress
- Inflation shock to 8% scenario
- Salary growth $\pm 2\%$ variation
- 20% equity market fall
- Longevity improvement +2 years
- Combined adverse stress scenario

E. Advice on Setting Contribution Rate

- Use best estimate as central projection
- Add prudence margin reflecting risk appetite
- Consider 75th percentile funding outcome
- Assess sponsor affordability constraints
- Phase contribution increases if necessary
- Document decisions under actuarial control cycle

[12]
[27 Marks]

Solution 4:

i) Main factors contributing to increase in deficit

- Salary increases higher than expected: Higher salary growth increases projected pension benefits, thereby increasing liabilities.
- Investment returns lower than assumed: Poor asset performance leads to lower asset values than expected, worsening the funding position.
- Members living longer than expected: Improvements in longevity increase the period over which pensions are paid, increasing liabilities.
- Higher pension escalation / inflation: If pensions are inflation-linked, higher inflation increases future pension payments and hence liabilities.
- Reduction in discount rate: Lower discount rates increase the present value of future benefit obligations, resulting in higher liabilities.

Other possible contributing factors

- Changes in demographic assumptions such as lower withdrawal rates or earlier retirements.
- Higher-than-expected expenses charged to the scheme.
- Data corrections revealing higher accrued benefits than previously estimated.
- Benefit improvements granted to members.
- Adverse changes in commutation or dependent pension experience.
- Increase in proportion of pensioners relative to active members.
- Delay or shortfall in employer contributions.

[6]

ii)

1. Establish clear funding objectives and policy

- The trustees and sponsor should first define clear funding objectives, such as:
 - o reducing deficit volatility,
 - o maintaining stable contribution rates, and
 - o protecting member benefits.
- Given the weakened sponsor covenant and volatile profits, affordability of contributions should form an important part of the funding policy.
- The mature nature of the scheme, with 50% pensioners, suggests greater emphasis on funding stability and risk control.

2. Set assumptions consistent with the funding policy

- Financial and demographic assumptions should be selected consistently with the agreed funding objectives.
- Assumptions should reflect the scheme's mature liability profile and reduced ability of the sponsor to absorb funding shocks.
- Asset valuation smoothing or long-term assumptions may help reduce volatility in contribution requirements.

3. Estimate liabilities and contribution requirements appropriately

- Appropriate actuarial methods should be used to estimate liabilities and required contributions.
- Since the scheme is mature and cash-flow negative may emerge soon, funding methods should place importance on liquidity and certainty of benefit payments.
- Scenario testing and sensitivity analysis may be carried out to assess:
 - impact of poor investment returns,
 - worsening sponsor covenant,
 - longevity improvements, and
 - changes in interest rates.

4. Monitor experience and analyse emerging risks

- Actual experience should be monitored regularly against assumptions.
- Experience analysis may identify causes of deficit growth such as:
 - poor investment performance,
 - lower discount rates,
 - longevity improvements, or
 - salary increases.
- The trustees should also monitor the sponsor covenant regularly, especially given the downgrade from A– to BBB and exposure to export market volatility.

5. Revise assumptions and funding strategy where necessary

- Assumptions and funding strategy should be reviewed periodically and updated where justified by experience or economic conditions.
- Any revisions should balance:
 - affordability for the sponsor,
 - stability of contribution rates, and
 - security of members' benefits
- The trustees may also consider gradual de-risking of investments as the scheme matures further.

[7]

iii) Sponsor covenant and impact on sponsor's business

- The trustees should carefully assess the weakened employer covenant before increasing funding demands. The downgrade from A– to BBB indicates deterioration in the sponsor's financial strength and increased default risk
- Since profits are volatile due to export exposure, the sponsor may be vulnerable to:
 - exchange rate movements,
 - global demand fluctuations,
 - trade restrictions, or
 - international economic slowdown

- Increasing contributions from 15% to 18% may place further pressure on the sponsor's cash flows and profitability
- Higher pension costs could affect:
 - business expansion,
 - investment plans,
 - debt servicing ability,
 - dividend policy, and
 - employee remuneration
- If contribution requirements become unaffordable, the sponsor covenant may weaken further, ultimately reducing support available to the scheme
- Trustees should therefore balance deficit recovery against affordability and sustainability for the employer.

Security of members' benefits

- The scheme has a mature profile, with 50% pensioners and only 15% active members. A mature scheme generally has lower risk tolerance because benefit payments are already falling due in the near term.
- De-risking the investment strategy may therefore improve benefit security and reduce funding volatility.
- Revising assumptions prudently may produce more realistic liability estimates and strengthen funding discipline.
- However, lower-risk investments may generate lower expected returns, potentially increasing future contribution requirements

Regulatory, legal, and taxation considerations

- Trustees must ensure compliance with pension legislation, scheme rules, and statutory funding requirements
- The trustees should consider whether revised assumptions remain consistent with the funding objective and investment strategy
- Tax implications should also be considered, including:
 - deductibility of employer contributions, and
 - any limits on pension contributions
- The revised investment strategy should remain consistent with the Statement of Investment Principles and regulatory investment requirements
- The impact on sponsor accounting disclosures and balance sheet volatility should also be considered.

Impact on professional advisers and other stakeholders

- The scheme actuary should advise on:
 - the appropriateness of revised assumptions,
 - contribution adequacy, and
 - likely future funding outcomes
- Investment advisers should assess whether the proposed de-risking strategy appropriately matches the liability profile of this mature scheme.
- Auditors may need to assess the impact on pension disclosures and sponsor financial statements.
- Members may have concerns regarding benefit security and the sponsor's weakening financial position.
- Shareholders may oppose materially higher contributions if they reduce profits or dividends.
- Clear communication with members, the sponsor, and regulators will therefore be important.

Overall

The trustees should balance benefit security, contribution affordability, investment risk, and covenant strength before implementing corrective measures. Given the mature nature of the scheme and weakening sponsor covenant, careful integration of funding and investment decisions will be essential.

[12]
[25 Marks]
