

# **INSTITUTE OF ACTUARIES OF INDIA**

## **SP2 - Life Insurance**

### **May 2024 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)

- The Age group of the loan takers is likely to be 25-40 years who are married individuals with young children with low income, high expenditure, high debt and high dependence of the family on continued employment for income. Hence, the customers are in their key period of life insurance protection. (1)

Why term assurance:

- A term assurance policy pays a lumpsum on death of the life assured within the term of the policy. It helps to repay the outstanding mortgage on the house and can pay for bringing up the children until such time as they can be financially independent. Thus offers protection to dependents. (1)
- The bank may require the life assured to have insurance equal to outstanding mortgage amount (1/2)
- As benefit is payable only on death within the term of the policy, term assurance is relatively cheaper and appropriate than other forms of insurance such as endowment and whole life policy. (1/2)
- May not afford high premiums of savings products at this stage of life and financial stage.
- The life assured need to pay family bills out of disposable income after paying mortgage interest payment hence may not have enough money to pay premium of savings product. (1)
- Hence, savings product may not be appropriate at early stage of life. (1/2)
- The mortgage loan terms tend to be longer and the cover (SA= Loan or higher) may continue even after the loan has been paid in part or full. In such cases, the same cover could be seen as providing the general (other than loan liability) protection needs of the customer and hence reducing the need for a separate cover.

Why convertible term assurance

- Policyholders with uncertain future needs for death benefit protection, may choose convertible term assurance policy or renewable term assurance contract even if policyholders' health may deteriorate. (1)
- As there is no underwriting at the stage of conversion, the policyholder can convert the policy since opting a new policy on standard conditions may require extra requirements or may not meet standard requirements. (1/2)
- The policyholders may be worried about the possibility of not meeting the conditions for standard terms. This might be because they are worried about becoming ill or about underwriting standards becoming more stringent in future. (1)
- This might also be possible to take out further term assurances at set dates in the future, which can be used to meet changing needs and also protection against inflation.
- With increase in age the disposable income may increase due to increase in salary or fall in expenses for children hence can afford higher premium for endowment / whole life. (1)

**(Max 5 marks)**

## ii)

- Capital requirements under convertible term assurance product are higher than that of term assurance product.
- This depends on the extent of any additional reserve required at the start of the contract and towards the end of the contract.
- Supervisory authorities require the companies to hold higher reserves for prudence as existence of options creates extra risk and uncertainty and hence higher cost for the Company.
- On the date of option, the Company needs to hold higher reserve e.g. for mortality if the policyholder opts for renewal of term assurance.
- The company is new in the market so it is possible that it will have a low level of available capital.
- The Company need to meet high initial costs:
  - a) for underwriting
  - b) market research
  - c) product development and product launch
  - d) marketing of product
  - e) product literature and other advertising cost
- Additional capital will be required to support any new business strain on the new product.
- There may be higher reserves as a result of using extra prudent assumptions given there is limited or no experience to base them on.
- Capital also needs to be held against the risks relating to the new product.
- It may sell very high volumes and so needs capital to support this.
- If business volume is very low, capital will be needed to meet fixed cost of the product.
- In particular, the company will need to develop and implement it's new distribution channel (bank assurance) which is different from the one currently being used i.e. direct marketing.
- Bank assurance channel may need training for the new product.
- The Company need to pay commission and other incentives to bank.
- The Company needs to develop its own administration system to support the product servicing.
- The employees may need training
- As the product is complex and company has no prior experience, the company may enter into reinsurance arrangement. Eventually, reinsurance may decrease capital requirement for the company.

(each point covers ½ mark, max 7 marks)

## iii) The key risks for Convertible Term Assurance Contracts are as follows:

## 1. Mortality risk-

The mortality experience of the portfolio is higher than expected.

The risk of selective withdrawal- policyholders with good health lapse the policy or exit the contract hence mortality experience of the remaining portfolio is higher than expected.

## 2. Anti selection risk-

As there is no underwriting at the policy conversion date. There is risk that policyholders with substandard health or poor health will opt for the option more than normal insured population.

### 3. Expense Risk-

For long term contracts with regular premium, the premium size is very low prior to policy conversion which can give rise to expense risk due to actual expenses higher than expected for the portfolio and due to expense inflation. (longer term contracts increase uncertainty in estimating rate of expense inflation)

### 4. Cost of option-

The company will charge a cost for offering conversion option in its premium. There is a risk that the cost of the option is higher than expected (charged) and so the premium charged to the customer is not sufficient.

Hence, the company can make a loss.

### 5. Reputational Risk-

As the product is complex, there is a risk that policy wording is not clear. This may lead to reputational risk for the Company.

There may be additional mis-selling risk if the options available are not well explained or can be misinterpreted.

(Each risk with suitable description one mark, max 5 marks)

#### iv) Advantages:

- Reviewable premiums help the insurer to modify premium rates to avoid future risks if actual experience turns out to be worse than pricing assumptions mainly due to adverse morality, expense and lapse experience.
- Ability to review would allow the company to keep initial premium rates lower (due to lower margins for prudence in premiums) and hence increase competitiveness.
- This would help increase sales.
- Economies of scale, lower fixed cost
- Lower level of guarantee
- Lower reserving requirement,
- Lower capital requirement.
- Premium can be revised downwards also to pass the benefits of favourable experience back to the policyholders should actual experience turns out to be better than pricing assumptions.
- Lower future premiums increase policyholder satisfaction
- Increase brand image/reputation of the Company
- It may be regulatory requirement.
- It may be aligned to market / industry / competitor's practice
- Better reinsurance rates as the premiums are not fixed.
- As the product is new, the Company may not have credible data to price correctly
- The distribution channel is new, it may impact claims experience.

#### Disadvantages:

- A Convertible Term Assurance product with reviewable premiums would create additional administrative burdens to review premium and collect
- Performing regular premium review is a complex process
- It involves expertise.
- It may involve more frequent experience investigations
- Any changes in premium rates will need to be updated in the IT systems.

- There will also be more frequent communications with the policyholders.
- There will be frequent update to bank assurance channel.
- The administration system needs regular update hence, this would add to the ongoing maintenance costs
- Risk of mis-selling if sales intermediaries are not trained to explain the reviewability features adequately
- Reputational risk / regulatory risk for the Company
- Frequent change in premium rates may not be liked by the policyholders.
- Increase in premium rates may increase policyholder complaints.
- Higher lapses
- And if lapses are selective, it could worsen experience further.
- This will increase premiums further
- Offering reviewable premiums may not be aligned to market / industry practice
- It may also make the sales process more complex and increase the risk of mis-selling.
- Risks are still retained in the 5-year periods between reviews

(Each point half mark and max 7 marks)

[Max 24]

### **Solution 2:**

i)

a) ***Conventional additions to benefits***

Under this system the company has the greatest discretion to control this risk once policyholders' expectations have been formed, through the management of its bonus distributions.

b) ***Accumulating with-profits***

All future non-guaranteed profit distributions are discretionary, so in theory the position is similar to the conventional system. However, there might be greater expectations of bonuses being linked to underlying (and hence market) investment returns. While this would not prevent insurers from over-declaring, it might make it difficult for the insurer to balance the equation by under-declaring during the good times.

c) ***Revalorisation method***

Here the actuary cannot really influence bonus rates, but that makes it all the more important for policyholders' expectations not to be raised misleadingly due to rash marketing literature *etc.*

d) ***Contribution method***

Here there is certainly a marketing risk if regular dividend distributions are lower than policyholders' expectations. It is this that actually prevents a company from deferring profit distributions by more than they actually do under this method. In cases where there is a significant terminal dividend, then the company can exercise some control over this risk with regard to the total payouts, in much the same way as under additions to benefits, though the scope for this will almost certainly be less under the contribution method. Again, in many respects, the issues for this method are similar to those for accumulating with-profits, although the link to market interest rates is not so obvious (the cash dividend is just an amount of money, whereas for accumulating with-

profits it is declared as an interest rate).

(6)

ii) The three components of dividend formula are as follows:

Interest rate surplus- excess interest on the reserve + premium

Mortality surplus- The expected death strain less actual death strain

Expense surplus- Excess of expected expenses over actual expenses, accumulated to the end of the year.

(1/2 for name of component and 1/2 for explanation , 3 marks)

iii)

- The Company determine the amount of distributable surplus and dividend formula will be applied with respect to this surplus.
- Some profits may be retained for shareholders.
- Some profits held by the Company for future adverse contingencies.
- Held for future distribution as terminal bonus.
- For more stable (smoothed) progression of dividends year to year
- To protect policyholders' reasonable expectations.
- To avoid adverse reaction to low dividend
- To setting a precedent of high dividend.
- Dividends may be adjusted for consistency with competitors.
- Regulatory guidelines
- Because of policy grouping
- There may be difference between the individual items in the dividend calculation and the aggregate items.
- Actual amount of death claims paid may be different from the actual mortality rate \* sum assured
- Actual mortality rates may be smoothened.
- Investment returns may not equal the aggregate of those allocated may be due to time of calculation
- Difficult to calculate exact capital gain when assets are sold
- Profits may include other components- commission and tax
- One off items of profit

(Each point carries half mark, maximum 6 marks)

[15]

### Solution 3:

i) Mortality Risk:

- The claim experience of Group Term may be more stable as the product will have higher pooling of risk due to higher number of lives being insured under the product.
- Individual Term Policy may have a higher sum assured with very low premium rate. This may give volatile claim experience.
- The Group product offers cover to its members without any medical screening upto free cover limit. This may happen that uninsurable lives may get insurance cover upto this limit.
- Individual term policy is underwritten and medical screening will happen depending on underwriting guidelines of the Company.

#### Anti-selection Risk:

- Group Term also has reduced anti-selection given that members of the schemes are employees of the same employer who do not normally be able to choose their own individual benefits or a group of customers of the bank availing loan to protect mortgages
- A reduced level of anti-selection would also be expected if group scheme membership is compulsory.
- Under individual Term, customers can select the sum assured and customers in bad health always keep their insurance policy in force.

#### Concentration Risk-

- Group Term tends to expose to higher level of concentration / accumulation of risk due to the employees working in the same premises / locations which expose group Term to higher catastrophe risk.
- Catastrophic risk is higher for a group policy than individual policy.
- Individual policies are not exposed to concentration risk by same premises or location.

#### Premium rate:

- Premium rates of a group scheme are highly competitive if size of the group is very high. Pricing is done using credibility factor.
- Hence, premium rates may insufficient to cover claim cost and future expenses in some cases.
- Individual policy priced depending on age, occupation, past health history of person hence premiums generally express the risk undertaken.
- Under group contract premium rates are renewable annually hence can increase if the claim experience of the scheme is not good.
- Premium rates under individual policy remains same for term of policy if the premium rates are not reviewable.

#### Lapse Risk:

- As the term of Individual Term Policy is longer , it is more prone to lapse risk.
- Group policies are one year renewable hence lapse risk is generally low, but if the policy is not renewed it is prone to lapse risk. Under long term group Policies under mortgage portfolio, the premium is collected at the start of the contract hence the lapse risk is low.

#### Reserving and Capital Risk:

- Group Term is annually renewable / reviewable compared to individual Term which is usually longer term with longer premium guarantee period. The reserving and capital requirements risk is thus higher for individual Term Policy.

#### Investment Risk:

- Individual Term Policy being longer term will require long term investments which increase investment risk for the insurer.
- Investment risk of Group Term Policy is lower as term is lower.

#### Expense Risk:

- Administration of Group Term Policy is simple and premiums are paid at the outset of the policy hence expense risk for collection of premium , administration is low for group policies
  - Under individual regular premium Term Policy , premiums are lower and collected across a large number of separate individual customers which increases the premium collection / remittance risk.
  - Group policy experience lower expenses due to economies of scale.
  - Individual Term Policy requires more staff to manage customer experience, attend to queries, onboard customers and monitor claims which then increases expense ratios for individual Term Policy
  - Individual Term Policy may also incur higher underwriting expenses.
- (Each risk and its explanation carry 1.5 mark – max 6 marks)

**ii)**

The main factors will be mortality view of the Company over the future period. This is based on following factors:

- Occupation- is the scheme “managerial”, “white collar”, “blue collar” or “mixture”
- Location- some parts of the country exhibit higher overall mortality than others. E.g. people staying in high rains areas may are prone to danger of flooding and water related diseases
- Level of underwriting- free cover limit
- Scheme experience- if credible
- Whether take up is voluntary or compulsory – compulsory cover gives less risk for anti-selection
- Any need for margins over best estimates – this is likely to be greater the longer the guarantee period

(each point carries half mark- max 3 marks)

**iii)** The factors that the Company may consider in designing the product features for the proposed accelerated critical illness rider are as follows-

1. The product design should meet Customer Needs:
  - Whether the customers need the product as a rider.
  - If yes, the types of benefits to be provided under the product
  - The list of different critical illnesses covered under the policy.
  - Definition of various critical illnesses
  - Exclusions if any offered under the policy
  - Policy terms & conditions. e.g. definition of waiting period.
  - The premium frequency should be designed to fit the income pattern of customers , e.g. all customers can not pay annual premium, hence options should be available to pay premium monthly, Qly, Hly, etc .
2. Consider conducting market research or customer survey so as to gain a firm understanding of the needs / reasonable expectations of customers in the country
3. Consider conducting market research to determine the target market, such as its potential size
4. the premium size that potential customers would reasonably expect.
5. Whether premium should be fixed or reviewable
6. Whether the Company want to add any guarantee and or option benefit for the



- product to improve its marketability.
7. This will also increase capital requirement for the company.
  8. As the competitor is also offering the rider which is profitable, the Company can review the product features offered by the competitor.
  9. The insurer can decide about the distribution channel to offer this product based on cost & benefit analysis
  10. As this is a new product and there is no prior experience for it, the company can opt for reinsurance by examining cost and benefit.
  11. The financial requirement for market research, designing the product, launching the product, etc to be assessed by the company
  12. Regulatory capital requirement along with cost of capital
  13. Any restriction of regulator about design of product or specific regulations for pricing & reserving needs to be considered.
  14. Any tax treatment
  15. Risk to insurer- a review needs to be done about addition of this product would increase overall risk to the company or changes risk framework.
  16. The company needs to understand consistency of the product with its existing administration system,
  17. How the product would help to achieve profitability criteria set by the Company or market share

(each point carries half mark, max 10 marks)

[19]

**Solution 4:**

- Market consistent value of a liability is the price that someone would charge for taking responsibility for a liability, in a market in which such liabilities are freely traded.
- To determine market consistent value of liabilities, future unknown parameter values and cashflows are set so as to be consistent with market values where corresponding market exists.
- Market values also exist for assets where corresponding market exists.
- Project the net liability cash outgo that would be expected in each future year from the existing portfolio of policies.
- Assuming the cashflows are certain and guaranteed amounts, the market consistent value is then found by discounting the cashflows at current risk-free rates of interest.
- The risk-free rate of interest to discount a guaranteed cashflow due in  $t$  years' time would be the current market redemption yield on a secure zero coupon bond of the same term.
- Alternatively, determine the portfolio of such zero-coupon bonds that could be owned at the present time that would produce exactly the same future cashflows as the liabilities.
- The current market value of this portfolio is then the required market consistent valuation,
- Risk free rates may exist on government bond yields or on swap rates
- It may be appropriate to make deduction to allow for credit risk
- For use of corporate bonds illiquidity premium is added above risk free rate to allow for credit risk.
- It may be difficult to obtain market consistent assumption for certain basis like mortality, persistency, expenses, for which there is not sufficiently deep and liquid market in which to trade and hedge these risks.
- Risk margin would be added to best estimate value of liabilities, it reflects the compensation required by the market in return for taking of those uncertain aspects of the liability cashflows.

- This could be done by adding margin to each such assumption or by using cost of capital approach.  
(First point carries 1 mark, subsequent each point carries half mark, **max 7 marks**)

**Solution 5:** i)

1. To match nature of liabilities-

- The annuity policy provides regular stream of income for a long time. Government and corporate bonds provide coupon payments which can be used to meet ongoing annuity payments.
- Government and corporate bonds are marketable and can be liquidated / realized readily to meet any liquidity shortfalls and meet immediate claim payments.
- Cash is required to meet on going liquidity requirements to pay annuity payments and ongoing expenses.
- Annuity payments are usually guaranteed in monetary, so fixed interest bonds can be used to match the benefit payments.
- Under index linked annuity, the benefits are typically linked to an index, and hence index-linked bonds can be used to match the benefit payments.
- Index-linked bonds might also be a good match for expenses / expense inflation.

2. Expected return-

- Expected return earned by corporate bonds is higher than government bonds of same term.
- This would enable the company to generate more investment returns and boost performance of the company.

3. Risk appetite-

- Risk appetite of the company depends on the level of free assets available with the company.
- The company may have lower free assets hence, more investments in fixed income bonds and index linked bonds.
- The company's risk appetite may require that assets backing liabilities provide guaranteed returns.
- Government bonds and corporate bonds issued by blue chip companies have less credit and market risk. Hence less risk for making losses and insolvency for the company.

4. General factors-

- There may be regulatory requirements to hold government, corporate bonds and index linked bonds to match the liabilities.
- Matching liabilities with bonds and cash reduces the company's solvency capital requirements to acceptable levels.
- Regulatory requirements may require insurers to hold government bonds to support strategic goals of the government.
- Diversifying assets across these assets enable the company to optimize risk-adjusted returns.
- Tax perspective
- Expertise of the company

(each point carries half mark, max 6 marks)

ii) The various risks faced by the company due to policyholders' behaviour are as follows:

1. Surrender / lapse risk
2. Liquidity risk
3. Expense risk
4. Regulatory / reputational risk
5. Selective withdrawal
6. Financial loss to company

(each risk carries half mark, 3 marks)

iii)

The insurer can take the following actions to manage the withdrawal of policies -

1. Change in product design-
  - The insurer may include market value adjustment and or surrender penalty to discourage the policyholder from surrendering the policy.
  - To reduce deferred period of the product.
  - To add some guarantee on interest rate during deferment period, this will also increase cost of the product.
  - Allow the product to offer commutation at vesting date.
  - Different options may be provided for annuity payments to address the customer need.
  - Make premium reviewable but it may cause further withdrawal if premium will be updated in upward direction.
2. Customer education-
  - Motivate / educate customers vide advertisement, direct education or through distribution channel to continue the policies.
3. Monitoring the actual vs expected withdrawal rates.
4. Customer services-
  - Improve customer services- customer enquiry, policy management/administration.
  - Annuity payment process
5. To demonstrate the capital adequacy the company can take following steps-
  - Maintain solvency ratio quite higher than the regulatory requirement of solvency ratio.
  - Maintain a good balance of free assets.
  - Carry lapse stress test, expense stress test and liquidity stress under worst case scenario.
  - Keep capital balances at such level that the Company can able to meet solvency ratio at a quite higher rate under stressed scenarios.
  - The Company can have parental guarantee for capital.
  - The Company can have contingency sources of capital.
  - Effective reinsurance arrangement for portfolio of Single Premium Deferred Annuity.

(For each risk with explanation 2 marks, max 8 marks)

iv)

General reasons:

- Alternative asset types enable the insurer to seek above normal returns especially if there are sufficient free assets to undertake more risk.

- The investment strategy also depends on risk appetite of the Company
  - Alternative asset types also enable the insurer to diversify their risk exposure beyond traditional asset types.
  - A more diversified asset portfolio may enable Company C to hold lower solvency capital requirement.
1. Equity derivative-
    - It reduces exposure to equity risk.
    - Protect equity portfolio falling below a certain point, downside protection
    - To enhance returns from equity portfolio
    - To stabilise capital position of the Company
    - To maintain solvency ratio
  2. Interest rate swaps-
    - It would enable the Company to pay floating swaps and to receive fixed swaps from the retirement date.
    - Fixed rate in swaps equal to interest rate in guaranteed annuity basis.
    - It reduces exposure to volatility in interest rate.
  3. Overseas ordinary shares:
    - The insurer may be seeking to match liabilities that are denominated in foreign currency.
    - The insurer may be able to increase the expected returns for the company's investment fund,
    - in particular the overseas markets / economies under consideration are expected to grow rapidly.
    - Inefficiencies in the global market may allow the insurer's fund managers to find individual countries whose markets are undervalued and hence have significant return potential.
    - The performance of local equities may be significantly lagging behind the performance of overseas markets.
    - The insurer may want to reduce equity risk by increasing the level of diversification across markets or geographical locations
  4. Pooled Investment Funds:
    - To obtain specialist expertise that the insurer does not have within their internal investment teams.
    - To obtain instant diversification by getting exposure to a wider pool of investments or investment risks.
    - To save on the costs associated with direct investment management.
    - Holdings in pooled investment funds are divisible which may enable the Company to gain exposure to particular asset types (e.g., property, infrastructure projects) without significant capital outlay.
    - There may be tax advantages associated with particular pooled investment funds. The company may be able to track returns of a specific index that is difficult to track as an individual investor.
    - Units of pooled investment funds may be more liquid / marketable than their underlying assets. e.g., property.

(General points carry one mark, each category will have maximum 2 marks, total max marks - 8)

[25]

**Solution 6:**

i) A Company will want to analyse the surplus arising over the year for the following reasons:

1. Show the financial effect of divergence between the valuation assumptions and the actual experience, exposing which assumptions are the more financially significant.
2. Show the financial effect of writing new business
3. Provide a check on valuation data and process, if carried out independently
4. Identify non-recurring components of surplus, thus enabling appropriate decisions to be made about the distribution of surplus to with profit policyholders
5. Give management information on trends in the experience of the company
6. Comply with regulatory requirements

(Each point carries one mark, maximum 4 marks)

ii)

- The company could perform a more detailed analysis of surplus to better understand the drivers of the loss and update future assumptions accordingly
- To identify the drivers of poor profitability
- The Company may stop selling the product. This may lead to lower business volume for term assurance which may increase fixed expenses.
- The Company may sell the product as a loss leader.
- The Company may revisit the pricing of the product and may increase premium for new policies or increase premium if the premium is reviewable under existing policies.
- The product may be sold online to reduce the cost of distribution.
- Underwriting may be automated to reduce cost of operation.
- The rider may be attached to the product to increase its marketability hence to increase business volume.
- Improve the underwriting practices so that actual experience will not depart too far from expected experience
- Claims control by claims underwriting, avoid fraudulent claims
- Revisit commission structure to minimise commission expenses
- Suitable reinsurance arrangement
- Increase customer servicing, training to distribution channel to reduce lapses
- Add group version of term assurance for diversification
- Revisit profitability criterion for the product.
- Change the target market for better mortality experience
- Cross sell with other existing products e.g. annuity products for diversification
- To reduce cost of capital
- Asset liability management – this will reduce the reserving requirement

(each point carries half mark, max 6 marks)

[10]

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