

# **Institute of Actuaries of India**

**May 2011 Examinations**

**Subject ST2 — Life Insurance  
Specialist Technical**

**Indicative Solution**

**Q.1)**

Types of guarantees under a ULIP plan:

- Investment guarantee
  - o Minimum return on
    - Gross, or
    - Net premiums
  - o Minimum Maturity Value
  - o Minimum Unit Price
- Expense charge Guarantee
- Mortality charge guarantee
  - o Charges guaranteed
  - o Cover will continue even if fund value is depleted
- Continuation of insurance without proof of insurability at maturity
- Ability to increase SA at specified intervals or events without proof of insurability
- Minimum surrender value guarantee

[Total Marks – 4]

**Q.2)**

- a) The static solvency assessment can only determine the solvency position of the company at a particular point of time.

However this will not enable the company's actuary to assess the ability of the company to withstand future changes in both the external economic environment and the particular experience of the company.

Many guarantees are hard to cost on a deterministic basis but we need to consider the possible impact of guarantees on solvency.

To do this requires a dynamic assessment of solvency.

This will involve the projection of the company's revenue account and balance sheet forward for a sufficient period of years so that the full effect of any potential risks may be apparent.

b) **Dynamic Solvency Assessment**

The solvency at a point of time of a life insurance company can be measured by comparing the value of its liabilities with the value of its assets. Given that the liabilities span over a long period of years, it is necessary to project the liabilities into future years, so as to assess the capital requirements. Effectively ongoing solvency needs to be tested, allowing for management actions (such as change in bonus and investment policy) where appropriate.

Consideration needs to be given to projection basis.

The projections could be done deterministically using expected assumptions, combined with assumptions with margins to test the effect of adverse future experience.

An alternative approach is to use stochastic assumptions with stimulation to access the level of profitability of adverse circumstances occurring.

One must also decide whether the projections should take into account only the existing business of the company or existing business plus expected future new business. Including new business is likely to provide the most useful assessment of ongoing solvency, unless it is intended that the company will cease to write new business.

It would be possible using stochastic assumptions and simulation to access the “probability of ruin” of a life insurance company. It would require the assessment of the probability that at some point of time in the future the life insurance company would become insolvent, either on a supervisory values basis or on an expected values basis.

If future projected balance sheets themselves require stochastic calculations, this can present significant modeling challenges and might necessitate the use of approximations.

An alternative assessment of the probability of ruin in respect of the existing business only could be made by projecting forward in the simulations just the revenue account of the company and seeing whether it ran out of assets before the last contract went off the books.

**[Total Marks – 9]**

**Q.3)**

(i) First a period of investigation will be required that is long enough to allow for trends to be detected – this means at least three periods of data are required. If there are significant changes in the economic environment, these should be taken note of. The data would then need to be divided by:

- Duration
- Sales method
- Frequency and size of the premium
- Original term
- Age
- Period
- {or divided into homogenous groups if no rating factors mentioned}

For each duration the number of policies surviving in-force to the end of the year will be divided by the adjusted the number of policies in force at the start of the year adjusted for the number of death claims and maturities to give the persistency rate.

The withdrawal rate is 1- the persistency rate. The persistency rates for rural and urban with otherwise identical characteristics can then be compared to assess if there is a urban vs rural effect. For each cell, the withdrawal rates by period can be compared to assess if there is a trend. The correlation between the different risk factors would need to be determined in order to examine whether correlation effects are evident.

Statistical tests required

Checks against industry or reinsurer data should be made to see if they are experiencing the experiencing the same

(ii) The analysis would be done by age, rural/urban classification, sex , duration , channel , smoker status and underwriting status.

The values should be projected from the investigation period to reflect the experience on policies sold in the future e.g. an adjustment may be required for HIV prevalence and anticipated changes in underwriting. The rates will be derived from adjusted standard table mortality rates where the adjustment is based on the experience analysis subject to credibility and possibly allowing for margins.

Given the lower persistency among rural clients, the adjustment should be sufficient to discourage selective withdrawal by rural clients.

This question is about selective lapsation. If rural clients are leaving, then chances are that competitors could be luring them away with better rates leaving us with lives with heavier mortality so checking against reinsurer or industry experience is considered important. However, if rural mortality was heavier than expected, the appropriate response is not to raise rural mortality rates as this will result in an insurance spiral.

**[Total Marks – 14]**

#### **Q.4)**

- a) Since the insurance company has not written annuity business, its biggest risk is the availability of data to base its assumptions on.

It could look at the industry data but seems like the entire industry was avoiding writing annuity business which may have triggered the new regulations.

There is a longevity risk associated with this contract, particularly with regard to understating the rate of improvement in life expectancy.

Since the country is a developing nation, there will be greater uncertainty in determining the mortality improvement rate as the health care system would

be improving every year. The rate of growth of the nation will impact the mortality improvement rates.

There is a risk that the existing distribution channels do not sell this product and hence a need to establish a new sales channel which may not be as productive and efficient as your existing channels increasing the costs. The company may have to write more than the minimum business prescribed by the regulators to recoup its development costs.

The current administration system may not be able to cope with the new requirements.

If this product has not been popular then the insurance company will have to spend on marketing this product. However there will be awareness created by the other life insurance companies as well.

There may not be suitable assets available in the country to back the long term liabilities.

There may not be reinsurance available for this product which would mean that the entire risk will be borne by the insurance company.

- b)** In a without profit immediate annuity contract, most of the future liability outgo is fixed in nature and therefore majority of the assets backing this contract will be invested in fixed interest securities.

The proceeds of the assets should match the expected fixed liability outgo.

The assets will be held in the same currencies as the liabilities.

The biggest concern for the insurance company is that there may not be sufficient long term fixed interest securities available to match long discounted mean term of the liability outgo.

In this case the insurer will have to use immunization techniques portfolio of fixed interest securities that provide the best match possible to the expected outgo.

The insurer can also opt to hedge itself by buying suitable derivatives. However since the economy is not fully developed, the derivatives may not be available.

The product is a non participating product and the additional investment returns it earns over the one assumed in pricing will increase its margins. Therefore to improve its potential returns, the insurer may choose to invest in assets that are expected to provide a slightly higher rate of return than government backing fixed interest securities.

These assets could include corporate bonds but this will be accompanied with a credit risk.

The views of the investment managers as well as the risk appetite of the shareholders will have to be taken into account.

The solvency position of the company will also play an important part in deciding whether the company can invest in corporate bonds as this will increase the required solvency margin and the company may have to call for additional capital.

There will also be expenses incurred in administering the contract and hence it would be appropriate to invest a small proportion of assets backing the contract in index linked securities if they are available or equities.

**[Total Marks – 16]**

**Q.5)**

(i)

- No company data
- No industry data
- No competition so premium rates can include large margins
- Offer limited premium guarantees that are reviewable with short notice
- Offer short term contracts such as term assurance, rather than whole life
- Rather offer compulsory insurance on a group scheme basis than individual policies.
- Must be simple to administer, so limited bells and whistles
- No medical underwriting, rather a declaration of health, questionnaire or something similar
- First option is to have either an accept or reject policy,
- Second option is to have exclusions. Exclusions may be more onerous to administer
- Underwriting at claim stage
- Premiums charged possibly by age bands, not too worried about gender.

ii)

- Reinsurer may have experience in a similar territory
- Could assist with setting risk rates
- May be able to advise on distribution strategy
- Possibly give input to likely lapse experience
- Will not do it for free and will require participation in risk
- Sum's assured are low so individual surplus reinsurance not appropriate
- Catastrophe reinsurance required
- Possible stop loss reinsurance to limit overall loss
- Proportional reinsurance will be appropriate
- Possibly quota share arrangement that is generous in the reinsurer's favour
- Include a profit share arrangement

- Financial reinsurance is an option to assist with setup cost
- Risk premium reinsurance is also an option, but may be more complex and expensive to administer
- Reinsurance commission is required to cover expenses
- As experience builds over time reduce the ceding percentage
- Will be on a treaty basis
- Legal risk may arise

**iii)**

- There may be a lack of legislation for reserving and solvency capital
- Use similar territories approach
- First principles
- No past data for mortality and lapses so initially use the pricing parameters
- Would not like to recognize profit prematurely
- Principle of prudence
- Company will have proportionally large set-up costs
- These may not be appropriate for expense assumptions
- Approximate methods may be initially be appropriate
- IBNRs
- Alternatively use a retrospective build up of reserves
- Retrospective build up should be on a gross premium method
- Allow for reinsurance
- Eliminate any negative reserves

**iv)**

## underwriting approach

- Historical data for mortality and lapses will form the basis
- Target market may be different for high sums assured
- Income of policyholders may be higher and may therefore have access to better housing, medical facilities and education
- Mortality experience may be lower
- Selection may be more of an issue due to high sums assured.
- Better informed policyholders may select against the company
- Medical underwriting may be required
- Especially for disability benefit
- Financial underwriting would be required to check policyholder income vs benefit
- Additional exclusions are applicable for disability benefit
- More options may be offered to sub-standard lives, such as premium loadings and more exclusions
- Specialist tests may be required, this may not be available in a developing country
- For disability claims underwriting will need specialist skills
- Access to medical reports essential

## Reinsurance

- Individual surplus reinsurance

- Facultative reinsurance for very large sums assured
- No history of disability, may require lower retention
- For disability risk premium reinsurance may be more appropriate
- Ideally mortality and disability should be on the same basis.

[Total Marks – 25]

**Q.6)**

**(i) Concerns of the company**

Being a new company, the economies of scale would not have been achieved and hence higher lapse rates would extend the expense overrun period.

In the early years of operation a new insurer will have expense overruns, which means that the expenses incurred are higher than the expenses loaded in the products while pricing. This is due to the high set up costs incurred by the company, for example, setting up a corporate office, opening branches and building distribution channels. Only once the in-force volumes reach a particular scale will the expense overrun get eliminated.

The high level of lapses would also mean the company would not be utilizing the operation and service department to the fullest as the company would have built the capability to service more number of policies. This may create uncertainty in these functions leading to high attrition.

There is also a possibility of the company losing money on account of high lapses and this will depend on whether the initial losses have been recouped.

The initial losses can be recouped if the product design allows for adequate surrender penalties. However there is still a loss of future profits. The net impact will depend upon the difference between the surrender penalty and future profits.

Even if the company is not financially worse off due to higher lapses, this will still be an area of concern because of the following additional factors:

- The high lapses could be because of the uncompetitive premium rates or poor product design which will also impact new business.
- There could be mis-selling issues. This will have an impact on the brand as well as lead to future litigations.
- The advisors may not be having adequate knowledge of the products.
- If poor customer service is a cause then this could lead to brand name suffering.
- The lapses could be selective and this may lead to worsening mortality



### **Actions taken by the company**

The company should carry out a detailed analysis of the lapse experience to highlight the contracts where lapse rates are not in line with the market.

Then carry out a survey on the lapsed policies to identify the cause of the lapses. Use the results to take appropriate actions.

If the customer service is poor, then take actions to improve service.

Check the training effectiveness on the advisors and test whether the advisors has adequate knowledge of the company's products.

Take measures to reinstate the lapsed policies. Also take actions to provide the sales team with information regarding policies coming up for renewal so that these policies can be prevented from lapsing.

Identify if there is too much biased toward new business commission versus renewal commission and make amendments.

Compare the company's products to those available in the market, in terms of premium rates, bonuses declared and fund performances.

If the company's products are not attractive then consider repricing or redesigning to make them more attractive.

If the fund performance has been poor, then the company can either look to revise its investment mandate in line with the market or change its investment management team.

Introduce some exit barriers in the product design so that the policyholders have a disincentive to lapse. These exit barriers can include surrender penalties or payment of loyalty bonus at specific intervals.

If one of the reasons shown by the survey is the poor branding, then the company would need to invest by spending on advertisement to improve its brand image.

- (ii) In determining the surrender values, the following principles should be considered.

Surrender Values should:

- Take Into account policyholders' reasonable expectation
- At early durations, not appear too low compared with premiums paid, taking into account any projections given at new business stage.
- At later durations, be consistent with projected maturity values.

- Not exceed earned asset shares, in aggregate, over a reasonable period of time period.
  - Take account of surrender values offered by competitors.
  - Take account of any regulatory requirements.
  - Not be subject to frequent change, unless dictated by financial conditions.
  - Not be excessively complicated to calculate, taking into account the computing power available.
  - Take into account, the value offered on other non forfeiture options like paid up policies, etc.
  - Be capable of being documented clearly.
  - Avoid selection against the insurer
- (iii) Since the company is in the expense overrun phase, it would not be relevant to base assumptions on the current year expenses.  
Expenses would have to be projected from the period of investigation to the period for which they will be used.  
The expenses would have to be adjusted for any known change in expense levels (benefits from any cost saving exercise) and also inflated.

The expenses would need to be subdivided into:

Direct Expenses: Expenses that depend on volume of new business or level of in force.

Overheads: Balance of expenses, e.g. those that relate to general management and service departments not directly involved in new business or policy servicing.

Further the company would need to split expenses into acquisition, renewal, termination and investment expenses.

The company would also want to split expenses between single and regular premium policies.

The company would also want to split expenses into those that are per policy, premium related or per sum assured.

Commission paid to advisors would be excluded from the investigation and allowed for as paid.

The main costs are likely to be salary and salary related.

These expenses would then be split by department.

The company would need to identify those departments that are directly involved in servicing policies and those that are overheads.

The expenses of departments can be split using a time sheet analysis.

There will be a cost relating to company's underwriting processes, for example cost of medical examination. These would be directly allocated to new business.

If the company has leased its office space occupied then the actual rent can be split between departments by the floor space occupied. If the property is owned by the company, then a notional rent can be used.

Computer costs should be allocated to departments by computer usage.

If the computers have been leased then the rental value can be used, else the cost of purchasing new computers could be amortized over the useful lifetime and then added to the ongoing computer costs.

Investment costs can be directly allocated to investment expenses and can be split directly by product line based on funds under management. These expenses are likely to be expressed as a percentage of funds under management so that they can be treated as a deduction from earned investment return.

One of capital costs can be split into relevant or exceptional items. Relevant costs could be amortized over the useful lifetime and treated as part of overheads. Exceptional items that are unlikely to recur can be excluded.

Having projected the expenses for the period for which they will have to be used, these would need to be converted into allowances per policy using:

- Number of new policies in that year
- Average number of in force in that year taking into accounts the revised lapses rates for renewal expenses.
- Average number of claims for termination expenses.

The company would want to compare its resulting assumptions to the existing ones used currently in pricing.

The company may then want to include prudent margins within the allowances.

**[Total Marks – 32]**

**[Total Marks – 100]**

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