

# **Institute of Actuaries of India**

## **INDICATIVE SOLUTION**

### **May 2012 Examination**

#### **Subject SA2 – Life Insurance**

##### **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.

**Soln.****1**

- (i) Due to certain regulatory changes and equity market movements, unit linked contracts have become less attractive to shareholders and the Company wishes to diversify into non-participating conventional products. In a recent meeting, the Marketing head suggested a regular premium product structure such the death benefit under the contract is at least 150% of the premiums payable under the contract. The sum assured on maturity under the contract is 120% of all premiums payable under the contract. Simple Monthly increases are made to the Maturity Amount of the contract expressed as a proportion of sum assured. The Marketing head further suggested that given this is a non-participating contract, the Monthly Increases to the contract should be made at a fixed rate, say 4% p.a. of the sum assured and should neither be discretionary nor be based on any external index.

(i) What are the provisions in the Indian legislation or regulation regarding the classification of business between participating and non-participating?

IRDA (ARA) Regulations defines "non-par policies" or " policies without participation in profits" to be policies which are not entitled for any share of surplus (profit) during the term of the policy.

Further, "par policies" or "policies with participation in profits" means policies which are not non par policies as defined under non-par policies.

- (ii) The product proposal will be discussed at a forthcoming Executive Committee meeting and your CEO has asked you to prepare a memorandum on risks inherent in the proposed product structure and what are the options available to company to mitigate or reduce the level of risk.

**ii. Describe the key risks that the product poses to the Company**

It's a non-par product- benefits are guaranteed and insurance co does not have any discretion The customers neither participate in the upside nor the downside of experience variance Any experience variance upside or downside will have to be borne by the company.

There is **significant reinvestment Risk** under in the product given the uncertainty at which the future premium and coupons from existing assets can be invested.

The fixed Monthly Increases at rate of 4% p.a. is onerous and may lead to significant cost of put option embedded in the contract.

In order for the contract to be non-par, there can be no discretion over surrender values.

Therefore the surrender value basis should be defined at outset.

Any increase in future interest rate would lead to fall in value of assets and if this is accompanied by the mass surrenders; there is a risk that the value of assets may be lower than the face value/surrender value of the policy, leading to loss to the company.

Even in the absence of surrenders, the requirement to reserve at surrender value would result in earnings being at risk.

Given onerous guarantees involved in the proposed product structure, the company will have to match the assets and liability very closely leaving lower scope for the investment manager to grab arbitrage opportunity available in the market and hence leading to lower investment income.

Given the onerous guarantees, the pricing will have to be done at prudent interest rate, which will make product uncompetitive against alternatives.

leading to lower than expected sale of the product.

.....lower sale may to lower contribution to the fixed initial costs of the company.

Low sales would lead to low profits.

Apart from these there are other common risk involved in pricing any contracts e.g.

The mortality turns out to be higher than that assumed.

Higher than assumed persistency may pose a risk if the product is lapse supported.

Expenses assumed may not be sufficient to cover the costs.

#### **Misselling risk**

(iii) **Describe what you would propose to reduce the level of inherent risks in the product.**

Given the potentially onerous guarantees embedded in the contract, its vital to evaluate the cost of guarantees.

Capital requirements may be assessed using stochastic or deterministic techniques.

The profit testing should be net of this cost of capital.

To reduce the **reinvestment risk**, the product may be offered as a limited premium payment contract. e.g. 5 pay for 15 year contract.

ensure that the duration of assets and liabilities are as closely matched as possible for such contract, leaving lower scope of shortfall in assets when interest rates in future rises or falls.

The Liabilities are likely to be of longer duration, given the lack of availability of longer duration bonds and zero coupon bond in India, stripped coupon arrangement may used to increase the effective duration of assets.

The minimum guarantee of 4% regular additions may either be reduced to let's say 3% or be linked some index e.g. certain proportion of G sec or Repo rate.

This will ensure that the Monthly Increases move in line with the investment income, in turn reducing the cost of guarantee.

To reduce the **mis-selling risk**, the product should be pitched as insurance contract rather than a pure saving contract to ensure that people are able to differentiate this contract from other pure investment alternatives available in the market.

Need based selling and explaining to the customer at the time of sale will help reduce the persistency risk. However, this product is likely to be priced lapse and surrender supported, because surrender benefits must be guaranteed at outset. Therefore, needs based selling is liable to increase persistency but reduce profitability.

The contract may offer lower GSV to ensure cap on losses due to some policyholders leaving the fund when the market value of the assets is lower.

Use the mortality experience of similar life insurance product targets to similar customer segments to price the contract.

Use persistency experience of conventional policies with some prudence ; need based selling and free look cancellation should help to reduce persistency problems.

use current business planning expenses/ Expenses assumed in the EV calculations to ensure consistency.

To reduce the risk that Sales may turn out to be lower than assumed; discuss with the distribution channels and use the estimates of the volumes produced by distribution channel.

The finance director is concerned that that the operating expenses incurred by the company may exceed the maximum management expenses allowed as per the legislative provisions and the product team needs to ensure that an appropriate level of expenses is allowed by the design of the contract.

State the legislative provisions on limitation on management expenses and commission of a life insurance company and how could they apply to the pricing of products.

The relevant legislation is Sec 40B of the Insurance Act 1938, and Rule 17(D) of the Insurance Rules, 1939

As Sec 40B defines "management expenses" to include commission, payable to them.

Sec 40A – Limitation of expenditure on commission - is also relevant.

The Brokers and Corporate Agents regulations prescribe the maximum remuneration

Sec 40A prescribes commission ceilings. Broadly these are:

On single premiums: 2%

On deferred annuity – regular premiums: FY 7.5%; subsequently 2%

Other assurances – regular premiums: FY 35%, 2nd and 3rd yrs:7.5%; thereafter 5%

Slightly higher commissions can be paid in the first 10 yrs of a new company. There are various provisos to the section.

Brokers & Corporate agents: Similar to agents with some changes

Sec 40B prescribes maximum expenses that could be incurred by a Life company. This read with rule 17D broadly prescribes a first year cost ratio of 90% and renewal year cost ratio of 15%.

Relaxations apply in the first 10 yrs for a new company.

Policies where the premium paying term is not more than 12 years, the first year expense ceilings are restricted to 7.5% multiplied by the premium paying term. There are various provisions and administrative provisions in the section.

**Application to pricing of products:**

While setting commission and expense assumptions for a new product, the actuary needs to take into account the provisions of Sec 40B and Rule 17D.

The maximum commission scales prescribed under Sec 40A should not be exceeded.

The maximum expenses including commission allowed under 17D depend on the premium paying term

e.g. the maximum first year expenses for a policy where premiums are payable for only 3 years is  $3 \times 12.5 = 37.5\%$  in the first year and the actuary has to ensure that a product where under only 3 premiums are payable is priced taking this into account.

In order to maximise the limits imposed by Rule 17d, the premium paying term should be extended to the greatest possible extent, subject to other risk-related considerations.

Although the expense ratio is computed on the entire portfolio of business, it may help in terms of setting unit expense targets for the company if the ceilings are adhered to in pricing for each product/term.

Note that when the proportion of short term business is high, the average premium paying term of the portfolio shortens and the permitted expense ratio may fall

Sec 40B(1) requires the actuary to furnish (in a prescribed form) the premium basis used for new business to the IRDA giving details of expense loadings as well as mortality, rate of interest and bonus loadings.

- (v) The Industry body has recently released the statistics of the market share of premiums written by each of the insurance companies in the market. It has been noted that your company's share of the market for term insurance contracts is declining for the last two years.

**Describe the possible actions open to the company to reverse this position.**

As a without profits contract with a guaranteed benefit term assurance is sold almost entirely on price, the main action would be to review premium rates with a view to reducing them.

It might be possible to reduce commission in order to improve premium rates or it may decide that increasing commission may increase sales.

The company might be prepared to reduce its profit requirement from each contract or find that its experience may be good enough to reduce premiums and still maintain profits.

The company might review the limits at which it seeks medical reports or examinations in the underwriting process.

A renewable term assurance policy which is issued for an initial short term but with guaranteed insurability on termination would reduce the initial premium rate although the rate would increase on renewal.

Adding an option to convert to a savings product will increase the premium but may also increase marketability and volumes sold.

If reinsurers can offer attractive risk premium rates, or provide capital financing on good terms via selection discounts, reducing the retention limit might enable premium rates to be reduced.

Increasing marketing expenditure on developing alternative distribution channel (e.g. ecommerce) may increase sales.

(vi) **Discuss the data and other key aspects the company you need to consider before implementing these actions.**

Review premium rates - in order to complete the review the company would need up to-date analyses of mortality, expenses and persistency, and fresh reinsurance quotes.

Interest is not a key item as reserves are not large.

A change in commission rates would need discussion with the sales areas.

Reduce profit requirement – the company will need to consider whether increased volumes and economies of scale would lead to an increased overall profit.

Review Underwriting limits - Healthy lives who can be accepted more easily are more likely to effect a policy. It is necessary to know the distribution of policy sizes and to compare the costs of underwriting saved with the extra claims that might arise if medical evidence is not obtained. Even if this results in no cost saving, added convenience might still increase business volumes.

Add conversion option - data to determine option costs largely come from other markets/reinsurers

Need to establish whether this will significantly impact sales.

Reduce retention limits - it will be necessary to consider the increased administration costs that would result.

Also, less retention should mean a higher share of profits go to reinsurers. Would need to consider whether this is offset by savings in costs of capital.

A cost/benefit analysis of any proposed marketing expenditure is required.

With all of the above proposals, it is necessary to assess the competitive position if implemented and the likely business volume that will result.

The marketing manager has recently joined the company from another Life insurer that only sells Unit Linked business. The marketing director wrote to you that many Scheme sponsors object to the application of a Market Value Adjustment (MVA) to the group gratuity participating contracts. He further mentioned that he never understood why it was necessary to apply an MVA and agrees with the views of scheme sponsors. He has specifically asked you to guarantee that the MVA will never be applied to group gratuity contracts. He further goes on saying that being able to offer these kinds of guarantees will help to write more schemes and grow the volume of business.

**Outline the points you would make in reply to the marketing manager. You should include an explanation of what an MVA is, why it is applied and whether or not you would consider removing the MVA.**

One aim of a with-profits contract is to give a return which smooths out fluctuations in the market value of the assets underlying the contract.

This is achieved by declaring bonuses to give a smoothed return from year to year.

This means that there are two values for the contract, the value based upon the market value of the assets underlying the contract and the smoothed policy value which the policyholder sees.

Imagine that we only had two with-profits policyholders and one decided to leave when the market value of assets was less than the policy value. Paying out the smoothed policy value would reduce the value of the assets left in the fund for the other policyholder.

For this reason, when people move out of the with-profits fund an adjustment is made to the policyholder's payout. If the value of the payout is increased, this is commonly known as a terminal bonus.

If the payout is reduced this is commonly known as an Market Value Reduction (MVR).

The adjustment brings the payout close to, but not exactly equal to the market value of the assets. A principle of with-profits business is that there is some of returns smoothing.

An MVA is typically applied only on bulk withdrawal or surrender.

#### **Why is it necessary?**

The MVA is essential to ensure that those leaving and those staying in the fund are treated fairly

In particular, some people may choose to leave when assets values are low. These people must not profit at the expense of the other with-profits policyholders. Allowing them to do so is clearly unfair. Hence MVAs are usually applied on bulk withdrawal or surrender to maintain equity.

MVAs are not usually applied on normal decrements ( deaths and normal retirements) in the schemes, even if asset values are low.

This is because these policyholders do not choose to leave at the time; they have chosen well in advance. They just happen to be leaving when asset values are low,application of MVR to them is clearly unfair.

#### **Can we guarantee that it will never apply?**

For people who retire on their chosen retirement date, the scheme sponsor is not deliberately profiting, since they chose their retirement date several years earlier. Therefore, it is reasonable to guarantee that the MVA will not apply on their selected retirement date.

A particular worry is that some scheme sponsors will make **bulk withdrawals** out of the fund when the market value of the assets has fallen. They could **contribute back** when the asset values rise. Without an MVA, they could make considerable profit from actively **churning**, at the expense of the other policyholders.

To protect the scheme sponsor who stays in the fund the insurer must retain the right to apply the MVA on switching or surrender.

For those retiring early, it is more difficult to say one way or the other. They may deliberately choose to retire when asset values are low. On the other hand, people do not choose to be made redundant or to retire early due to ill-health. Since these people are not choosing when to leave, we might be able to guarantee not applying an MVA.

There is a risk of mass redundancy when asset values are low, as part of a general economic downturn. Therefore need to retain the right to apply an MVA on mass redundancy.

However, it may be preferable to retain the right to impose an MVA even in these cases.

The suggestion to have no MVA on early/ill-health retirement or unemployment would also give rise to quite severe potential administrative complications.

Instead, it would be beneficial to focus marketing efforts on getting distributors to understand the benefits of having the right to impose an MVA.

Your company has been asked to quote for group term life for an employer-employee scheme. You have been provided with the following details of the scheme and have been asked to provide a quotation for one-year renewable group term cover. Currently, the scheme is self-insured:

Name of Scheme: Sandhu Pharma Pvt. Ltd.

Industry sector: Manufacturing and distribution of pharmaceutical products

Locations: Production facility – Himachal Pradesh

Head office – Shimla (few employees of head office are within factory site)

Distribution offices - 12 in metros and other large cities

Two benefit designs are being considered by the client:

(a) Fixed sum assured of Rs. 1 million for each employee

(b) Sum assured equal to 3 times annual salary

Current membership details: (amount in 000)

Grade	Nos of Lives	Annual avg salary	Avg Age
CEO	1	6000	55
Director	10	3500	47
Managers (Sales)	60	2,000	38
Managers (technicians)	250	800	35
Sale staff	1,500	300	30
Total	1,821		

Year	2008	2009	2010	2011
Average no. of employee	951	1,118	1,316	1,548
Nos. of deaths	2	0	3	1

i. Describe the approach that you would take to underwriting these two proposals for insurance.



**Underwriting approach**

- § Scheme underwriting is required for both benefit designs.
- § Consider .... nature of duties - extent of manual work(closely related to accident risk.
- § In this case, consider exposure to special hazards - e.g. toxic / inflammable Chemicals
- § ... accumulations of risk - (e.g. proximity of head office - where CEO and other highly insured lives presumably work)
- § ... cat. risk related to nature of industry - e.g. chemical fire / explosion
- § ...travel in the course of duties - business is widely distributed
- § Establish cause of deaths in recent years - may offer clues to e.g. accident risk - in this case, unlikely to yield much info. because few deaths.
- § Consider impact of accepting scheme on balance of group portfolio - by industry, geography.
- § **Financial underwriting** ..... At 3 \* salary, level of benefits is very reasonable.
- § Max. cover under first option is 4 \* salary, which is also OK.
- § **Medical underwriting** ..... For flat cover option, no individual underwriting is required (assuming reasonable take-up rate of scheme - for flat cover, level of benefits is either acceptable to the insurer or not.
- § Offer free cover limit (FCL) for second option.
- § FCL will depend on whether scheme is voluntary or compulsory . lower or none for voluntary
- § FCL usually varies by group size and average SA
- § ... aim to offer cover to large majority without medical underwriting.
- § Largest covers should be individually underwritten. Poor health of CEO ...or other decision-maker may be motivation to introduce scheme.
- § Any substandard rating is generally applied only to SA above the FCL only
- § If voluntary scheme, require members to join at outset to get FCL.
  - Similarly new joiners have to join as soon as they become eligible.

Following your initial quotation, the CFO of Sandhu Pharma has commented that the premium rate of Rs. 2.2 per thousand of sum assured quoted for benefit (a) is much higher than warranted by scheme's historic claims experience. Discuss briefly the points that you would make in your response to the CFO to justify the rate quoted.

- § Claims experience is somewhat below cost of insurance
- § ... but expected number of claims is few in any case
- § ... and expect number of claims to vary considerably from year to year (high 1/2 volatility since scheme is young / modest size)
- § So, scheme's own experience is not statistically credible
- § Premium is based on expected experience of many similar types of group, rather than its own experience
- § Not insignificant exposure to workplace hazards and catastrophe risk
- § Insurance cover buys certainty of cost of claims outgo

- § Protects against downside risk of large number of claims
- § In this case, company would be worse off if there are 3 or more claims.
- § Insurance involves the pooling of risks - so must expect premium to be above burning cost in some years
- § Insurer has to meet expenses of setting up and maintaining the cover ...
- § .... including stamp duty
- § .... and regulatory capital costs - reserves and RSM
- § .... and requires to make a profit for carrying the risk
- § (Other things being equal) competitively priced relative to cost of individual business because of efficiencies of group administration etc
- § Can consider refund structure for continued good experience

[50]

## Soln.2

- (i) **State the regulatory considerations you would have in setting the statutory valuation interest rate assumption.**

The relevant Regulatory considerations for setting the valuation interest rates are set out in the IRDA (Assets, Liabilities and Solvency Margin), 2000 Regulations

All assumptions used for determining the statutory liability should be based on prudent assumptions of all relevant parameters including the valuation interest rate.

The value of each parameter, including the valuation interest rate, shall be based on the insurer's expected experience and shall include an appropriate margin for adverse deviation.

The assumptions for valuation, including the valuation interest rate, should not be subject to arbitrary discontinuities between successive valuations.

Another relevant aspect of regulation is to consider the nature and term of assets representing those liabilities and the value placed on them and shall include prudent provision against the effects of possible future changes in the value of assets on the ability of the insurer to meet its obligations arising under policies as they arise.

The valuation interest rate should not be higher than the prudent assessment of yield from existing assets backing the liabilities of the insurer and the yields expected from future assets.

Additional considerations include the composition of assets, expected cash flows from the investments, likely future investment conditions and reinvestment and disinvestment strategy used in managing future cash flows. Risks associated with investments including principal and coupons. Expenses associated with the investment management of the insurer

The valuation interest rate should have regard to decline in future interest rates, particularly for non-participating business

The valuation interest rate used for participating business should be consistent with the level of bonuses used in the valuation

The valuation interest rate should have regard to changes in the risk-free rates of interest for single premium business and regular premium business.

The valuation interest rate adopted should be reviewed for consistency with other relevant parameters such as inflation rate and the bonus scales used for participating business

(ii) **Discuss the professional guidance applicable to you in setting the statutory valuation interest rate assumption and the valuation inflation rate.**

Relevant professional considerations are set out in APS1, APS 2 and APS7 on setting the valuation assumptions and determining Margins for Adverse Deviation

APS1 requires the assumed value for each valuation parameter to consist of an expected level and a margin for adverse deviation (MAD). The size of the MAD would reflect the level of uncertainty in the interest rate environment

APS2 further elaborates on the use of prudent assumptions for statutory valuation for example by considering resilience of the valuation to changes in circumstances. Specifically, changes to asset values not matched by corresponding changes to the liability values require consideration of additional provisions.

The valuation interest rate, like other valuation assumptions, should not be subject to arbitrary discontinuities from one year to the next. However, this does not preclude changes due to actual or anticipated changes in market yields

For participating business, additional considerations arise including allowing for the change in bonus rates that would arise as a result of interest rate movements. Thus, the increase in interest rates could be reflected by an increase in valuation rates of interest for Par business, but consideration needs to be made for an increase in bonus rates and one would typically increase the bonus rates such that the reserves before and after the change in valuation interest rate are the same. This avoids any reserve discontinuity.

Reserves for participating business may also be set equal to the asset shares, provided they reflect PRE.

The changes made to the bonus rates must ensure that these reflect the most recent view of Policyholder Reasonable Expectations, in line with APS2.

The effect of a decline in risk-free rates should be allowed for all lines of business including single premium and non-par business

There is a need to consider all future interest rate scenarios - this may be addressed for example through the use of stochastic scenarios of future interest rates. APS 7 recommends running a series of projections to determine the sufficiency of reserves in various adverse scenarios

APS7 requires the consideration of investment guarantees provided under any contracts and the MADs need to allow for the risk of such guarantees biting under adverse scenarios

Thus, in relation to the valuation interest rates, for participating business any increase in the rate is likely to be offset by a corresponding increase in bonus rates thereby having a neutral impact on the reserves.

For non-participating business, an increase in valuation interest rate may be considered subject to other aspects such as results of the stochastic reserve sufficiency, the need to allow for Investment Guarantees is met.

If the interest rate outlook is more uncertain, the best estimate level may be increased along with an increase in MAD

For unit-linked business, the unit reserves are not affected by the choice of valuation interest rates. However, the non-unit reserves are.

The choice of valuation interest rate for non unit reserves under unit-linked business would have similar considerations as non-par business. The unit fund growth rate also impacts the non unit reserve through its impact on charges, particularly fund management charge and mortality charge for level death benefit products.

The valuation inflation rate should be set by reference to the valuation interest rate, taking into account the expected expense inflation of the company.

This may have some link with external inflation indices but internal factors such as the composition of expense inflation and its drivers would play a key role. For example, wages are typically a large component of an insurer's expenses, and the outlook for wage inflation must be considered in setting the valuation inflation rate

APS 2 does not require a MAD for both the valuation interest rate and valuation inflation rate provided there is a MAD in the valuation interest rate resulting in a MAD in the difference between the valuation interest rate and the valuation inflation rate

Allowance for tax must be made reflecting the Company's tax position

The valuation basis should be considered in its entirety as well. Some additional considerations at the aggregate level would include allowing for policyholder behaviour in the higher interest rate environment eg higher policy lapses/ surrenders.

**Both participating and non-participating products have an embedded guaranteed interest rate to meet all guaranteed cash outgoes. The guaranteed interest rate for the participating business at an aggregate level is 2.0% and for non-participating business is 4.0%. The participating business offers guarantees on surrender and maturity. The CFO comments that the rise in interest rates should lower the cost of guarantees for participating and non-participating business which would enable the Company to offer improved returns to policyholders. You comment that there are additional considerations in determining the cost of guarantees for in-force business including the aspect of policyholder behaviour.**

iii. Explain the term policyholder behaviour in the context of determining the cost of guarantees.

Policyholder behaviour refers to the behaviour exhibited by policyholders in exercising certain options and choices available in the products purchased

Life insurance products typically offer choices and options such as the ability to lapse their policies, surrender their policies, in some instances partially withdraw funds from their policy (eg under unit-linked products), take loans against their policies, allow policyholders to increase premiums, take additional insurance etc

The existence of choice and options allows customers to alter their behaviour depending on how the product is performing. For example, if a maturity guarantee becomes more valuable the lapse/ surrender behaviour may reduce. This will impact the overall cost of guarantee which may rise as a result of the change in behaviour

In ascertaining the cost of guarantee an appropriate consideration of policyholder behaviour must be made. This could be done by dynamically linking the behaviour, such as lapse rates, with relevant factors such as interest rates

Out of all the possible options and guarantees some would not be affected by policyholder behaviour eg a guaranteed minimum death benefit

**iv. Describe the factors that would be relevant in determining the cost of guarantees for the participating business sold by your Company, including policyholder behaviour?**

The first step in determining the cost of guarantees for participating business would be to understand the various guarantees offered.

This would require an evaluation of the product features of each of the participating business.

These would typically include a guaranteed sum assured that would be paid on maturity leading to a maturity guarantee, applicable at a fixed point in time

The sum assured, or a multiple of it, would also be payable at death and this would also lead to a guarantee during the policy term

The terms and conditions offered on surrender would typically also include some embedded guarantees

The product features should also be evaluated for any other options, which may implicitly contain guarantees. Examples of such options include ability to purchase additional amount of insurance eg on specific events such as anniversaries, ability to increase premiums

For in-force participating business, all accrued bonuses declared become guaranteed. These would also need to be included in the assessment of guarantees as they cannot be varied.

Having established the various options and guarantees appropriate methods would need to be considered to value them

Before applying detailed methods it would be appropriate to get a high level sense of the materiality. This could involve using more simplistic methods to prioritise and focus on the options and guarantees that would lead to a material cost of guarantee

Given that the guarantees are being evaluated for Participating business one of the most critical factors would be the ability to change bonuses and therefore mitigate the cost of guarantee

To allow for changes in bonuses, due regard will need to be paid towards past practice of bonus declarations including whether bonuses have been managed actively or passively.

In addition, an assessment would be required of the overall Policyholder Reasonable Expectations created through the various sources eg policy documents, benefit illustrations, market practice etc. When there is PRE that establishes management action on bonuses would not be taken, this would need to be factored in and would lead to higher costs of guarantees, *ceteris paribus*

For modelling, it would be necessary to establish a link between changes in interest rates and the resulting changes in bonus rates taking the factors described above into account. This link would then be incorporated in the model used for evaluating cost of guarantee. Other areas of management action to allow for in the modelling of Cost of Guarantees include investment mix of asset shares and any charge on asset share

Appropriate methods would be required depending on the nature of the option/ guarantee. For example, certain forms of guarantees based on say interest rates would require the use of stochastic techniques in order to determine the cost.

Stochastic techniques would require an integrated Asset Liability Management model to be used along with output from an economic scenario generator. The output would typically contain asset variables such as interest rates for various bond tenors, inflation, equity.

The ALM model would require incorporation of policyholder behaviour. This could be done for instance by using a dynamic link between lapse rates and interest rates.

In the current circumstances, with interest rates rising there is a good chance that the bonus rates of the Company may increase with a lag as these are typically based on the portfolio earnings rate which includes both new money rates and old money rates at lower levels

Such a scenario may give rise to disintermediation risk - the risk that policyholders would view alternate products at the new money rates favourably and lapse the existing products.

Lapse rates may therefore be set at a base level which would typically vary with policy duration. In addition, a factor based on the external interest rates and the bonus rates could be used to modify the base level by incorporating policyholder behaviour

The modelling of policyholder behaviour is not a precise science and thus various sensitivities should be run to establish a range of outcomes

The ALM model would be run for each of the scenarios, to understand the impact of asset and liability links. The presence of investment guarantees, for instance, would trigger a mismatch between assets and liabilities and may lead to a shortfall. The ALM model would thus allow a shortfall to be determined for each scenario

This information along with the choice of risk measure can be used to determine the cost of guarantee.

It would be common to use the average shortfall, discounted to the date of valuation using the scenario specific discount rates, to arrive at the cost of the guarantee

**Your Company publishes financial results on an embedded value (EV) basis in addition to the statutory accounts. This involves, in particular, the use of a risk discount rate based on the prevailing risk free rate plus a risk premium. Your Financial Reporting Actuary has completed the analysis and noted that the Return on Embedded Value (defined as the internal rate of return assuming opening EV and any capital injections as negative cash flows and shareholder dividends and closing EV as the positive cash flow) for the last financial year is less than the risk discount rate. The following additional information is available to you:**

- **In the last year, the Company's Net Worth as a proportion of the EV has gone up from 30% to 50%,**
- **The Company had a capital injection in the last quarter of the financial year,**
- **Experience variance was marginally positive ignoring acquisition expense overrun but was negative including it,**
- **Experience variance was marginally positive ignoring acquisition expense but was negative including it.**
- **The Company does not have a maintenance expense overrun.**
- **There were no shareholder dividends in the financial year.**

**The CFO queries you on the possible reasons for the Return on EV to be lower than the risk discount rate. He comments that the acquisition expense overruns being related solely to new business should not affect the ROEV as EV only considers in-force business**

**Describe the use of Return on EV as a measure of shareholder profitability and contrast it with new business profit margin.**

The Return on EV reflects the growth in EV, taking into account capital movements such as capital injections and capital repatriation, e.g. through shareholder dividends

As Embedded Value reflects the Shareholders' interest in the business, ROEV is a good measure of the Company's performance from the perspective of shareholders

ROEV reflects the performance during period of both the in force business at the beginning of the period and the new business written during the period.

This includes experience variance - lapses, mortality, investments and expenses. Thus, the shareholder impact of each of the experience elements, relative to the assumptions adopted at the beginning of the period would impact the ROEV

If the company has an expense overrun, its impact during the period would also be reflected by depressing the ROEV

Thus ROEV is a more holistic measure of profitability by taking into account the impact of persistency and mortality variances in respect of the in-force business. It also allows for the impact of changes in assumptions and therefore prevents management from over estimating new business profits. In the case where aggressive assumptions are adopted by management, the experience variance is likely to be negative and thus eventually the impact is captured in ROEV

The impact of writing new business would be captured in both the Net Worth and Value of in force at the end of the period. The Net Worth impact would depend on the new business strain, which in turn would be a function of the products sold and their design. The Value of in force would increase by the value of new business remaining at the end of the period

The long term nature of contracts makes it difficult to arrive at a Return on Equity measure and ROEV is a possible proxy for ROE

Profit margin is a profitability measure relevant only for new business.

It relates to the shareholders' interest in new business written, expressed as a proportion of the present value (sometimes Annualised Premium Equivalent)

**Explain the possible reasons for the Return on EV to be lower than the risk discount rate for your Company to address the CFO's queries.**

As set out above, the ROEV is influenced by several factors which are considered below  
Capital movements both inflow such as capital injections and outflow such as shareholder dividends have an impact on ROEV. The capital injection in the last quarter is likely to be utilised for funding the Company's business activities over a period of time and the immediate impact would be to depress ROEV since it would not yet have generated returns.

Over time, the impact of capital injection would depend on whether it is free surplus in which case the investment policy of such free surplus and the actual investment performance would drive the returns so generated from the capital. If the capital is invested in risk-free investments the returns generated would also drive the ROEV to be lower than the risk discount rate (RDR)

Since there were no shareholder dividends there are no additional capital movement considerations for ROEV

A significant driver of the RoEV is the unwind, or notional interest, on the opening Value of in force which represents the one year roll forward of the VIF. Given the EV methodology, the unwind would simply equal the RDR

Experience variance ignoring acquisition expense overruns is positive and will increase the ROEV all else being equal. However, since the aggregate experience variance including expenses is negative the overall impact will drag down ROEV

On acquisition expense overrun, the CFO is incorrect since the new business written during the last FY, and the associated acquisition expense overrun would be included in the ROEV and will depress it being a negative element.

The impact of writing new business needs to be viewed along the various impact items. The value of new business, net of actual costs incurred, may be positive or negative. If the latter, it will be a drag on RoEV.

The impact of any change in assumptions would need to be considered. Since the experience variance excluding the impact of expense variance is positive, the impact of both mortality variance and persistency variance would need to be analysed in making any changes to the basis on the valuation date. Any change in basis would impact the experience variance during the period if measured against the closing basis, as well as impacting the VIF on the valuation date and thus the RoEV

Net Worth comprises of two elements: Required Capital and Free Surplus

The impact of Net Worth on ROEV is a function of its relative weight in the EV as well as the investment policy for the Assets backing Net Worth



It is possible that the investment policy for a portion of the assets backing Net Worth may be more conservative. For eg these may be invested in risk-free investments and thus the return generated on them would typically drag the ROEV to be lower. On the other hand, assets backing the solvency margin requirement for unit-linked business may be invested in assets like equities to immunise the portfolio as the requirements are largely driven by unit reserves.

Depending on the level of Free Surplus, the Company may have a more aggressive investment policy for its free surplus including investments in risky assets such as corporate bonds, equities and real estate.

The actual investment performance of the assets backing net worth for the last FY would be a significant driver of the ROEV.

As the Net Worth to EV ratio has increased last year, it is likely that the returns on assets backing Net Worth are lower than the RDR driving the ROEV to be lower than the RDR.

Thus, there are several factors that could lead to the ROEV being lower than the RDR with the key ones being an increasing proportion of Net Worth and its likely investment (partially or entirely) in risk-free assets, the acquisition expense overrun and the capital injection in the last quarter of the FY.

**Your CFO is considering ways to strengthen the solvency balance sheet of your Company. He mentions that financial reinsurance could be used to improve the Company's solvency ratio and describes a proposal from a reinsurer that would allow your Company to use x% of the value of in force (VIF) from the embedded value to be recognised as an asset available to meet the Company's required solvency margin. This would be achieved by the reinsurer providing an agreement that would allow the Company to recognize x% of VIF as an asset in the form of a non cash reinsurance receivable, in return for an ongoing charge on the future distributable earnings.**

**v. Describe the steps that a reinsurer would take to determine an appropriate value for x.**

The key step for a reinsurer to determine an appropriate value for x would be to establish the risks and uncertainties surrounding the value of in force. As the VIF acts as a sort of collateral for the reinsurer, it would like a high degree of certainty of repayment.

This would involve looking at:

Completeness and accuracy of data used to arrive at the VIF,

The methodology adopted and its appropriateness to value the shareholders' interest in the business.

Volatility of the future shareholder earnings by line of business. This could be ascertained by performing sensitivity analysis on various parameters.

These would include sensitivities on persistency (higher or lower depending on the impact by product), mortality, expenses, investment returns.

Any policyholder options and guarantees and the associated policyholder behaviour eg change in lapses would need to be considered.

For the unit-linked line of business, investment performance and fund management charges may be a key driver of shareholder earnings in which case there may be a need to consider stochastic analysis to understand the sensitivity of market movements

For Participating business, the Surplus Distribution regulations and the 90/10 sharing of surplus would need to be kept in mind

In addition, the Company's bonus strategy would affect the timing and amount of future appropriations. Given the amount of discretion that the Company has over bonus declarations, it is unlikely to be included in the VIF used to determine the x%

The Value of In Force for Par business would also have regard to the shareholders' interest in the Par Fund FFA

The reinsurer may suggest that Par business could be kept outside the purview of the financial reinsurance agreement given these additional complexities

Source of earnings analysis would be another aspect to understand the composition of earnings amongst investment, mortality, lapses and expenses

Stress events by combining individual elements and understanding the impact on VIF eg interest rate movement coupled with high lapses etc

Another element to consider would be the timing of distribution of earnings eg what percentage of distributable earnings would emerge in the next 0 - 5 years, 6 - 10 years etc. This may have an important bearing on the uncertainty of the future distributable earnings - eg a short maturity profile may indicate less uncertainty

Other aspects which would impact the realisation of the VIF such as regulatory changes, fiscal changes would need to be considered

The final level of x% would thus be a judgement call made considering the above analysis and would be higher if the risks and uncertainties associated with VIF were lower

**Ignoring any constraints imposed by the IRDA, what additional considerations will you have in accepting the reinsurance receivable derived from the VIF, as described above, to back a part of the Company's available solvency margin?**

When viewing the assets backing solvency margin, it is important to consider the realisable value of assets

It is also relevant to consider liquidity of the assets as the assets may be required to be liquidated at short notice

Notwithstanding the due diligence performed by the reinsurer, additional internal considerations must be given to consider the reliability of the VIF, its sensitivity to changes in experience and assumptions

If the VIF is based on maintenance expenses lower than the current levels, ie a situation where the company is facing maintenance expense overruns consideration should be given to the present value of future maintenance expense overruns and how they have been treated in the VIF.

Given that the VIF Asset on the balance sheet is based on a reinsurance transaction, this brings an additional element of credit risk of the reinsurer which needs to be considered

Since the RSM requirements are based partly on the reserves, holding assets which move in line with the reserves immunises the Company from changes in RSM requirements and the resultant change in ASM. The reinsurance transaction may result in a reduction in the liability for the Company or an increase in the asset. If the liability is reduced to the extent permissible under statutory limits, it will require a review of the investment strategy of the assets backing the existing available solvency margin to ensure that these represent an immunised position when compared with the RSM

For instance, a large part of the unit-linked reserves for the Company would be the unit reserves and thus holding the Reserve related portion of the RSM in the same underlying assets as the unit reserves themselves would achieve this immunisation. Assets backing the RSM requirement, such as x% of VIF, would reduce this immunisation. For example, a spurt in unit prices would lead to an increase in RSM which may not be backed by a corresponding increase in the reinsurance receivable asset. This may lead to a reduction in free assets which would require additional monitoring, including a consideration of the solvency ratio and whether additional capital may be required to restore the solvency ratio to target levels.

For Participating business, additional consideration should be given to the Assets backing RSM. For example the size of the Par FFA, and its contribution to Par RSM requirements. How much of the Par RSM is being backed by Par FFA and a portion of the VIF Asset? As mentioned elsewhere, it is unlikely that the Participating Business VIF may be excluded for the purpose of determining the reinsurance receivable.

Additional considerations such as the period of amortisation of the reinsurance receivable against actual future distributable earnings would be agreed between the Company and the reinsurer. Thus, in addition to the current impact of the reinsurance receivable on the solvency position, a projection of the future solvency position should be carried out with and without the reinsurance transaction.

**[50]**

**[TOTAL MARKS – 100]**

\*\*\*\*\*