

# **Institute of Actuaries of India**

**October 2009 EXAMINATION**

**Subject ST3 — General Insurance**

**Specialist Technical**

MARKING SCHEDULE

1(i)

*The report should mention the following points*

The basic investment principle of a general insurer is to maximize investment return, subject to meeting all contractual obligations and recognizing the uncertainties involved.

The nature, term, variability and currency of the liabilities should be considered while preparing the investment guidelines.

Assets should be chosen which are appropriate for the liabilities, i.e. assets should have similar term to the liabilities and they should respond to background influences (e.g. inflation movements) in the same way that the liabilities do.

Motor is a combination of own damage and third party liability. Suitable estimation should be made about the proportion of bodily injury claims in the portfolio and a different investment strategy should be adopted for the two liabilities.

The claims from Workers' compensation and Motor third party bodily injury are longer terms and linked with wage inflation. The assets backing these liabilities should be held in assets of matching terms and which provide protection from wage inflation to some extent, e.g. equities.

The uncertainty underlying the liabilities and the need to allow for payment of claims before recovering from reinsurers. Means that insurers need a high level of marketability for many of their assets

Sensitivity of cash flow results to changes in assumptions is important

Insurers with large free reserves can adopt a more risky investment policy in pursuit of higher returns.....

... This might involve more volatile assets, fewer "secure assets", and some mismatching by term, nature and/or currency.

The free reserves should not be measured only in absolute terms but should be compared with:

The premium written each year

The ultimate liabilities arising from each year's claims

The absolute size of liabilities an insurer is subject to at any given time

Any statutory minimum

Funds held with brokers, agents, policyholders and reinsurers are not available for investment.....

...As these funds are effectively invested short, the balance of the assets might be invested longer.

There may be regulations in place about certain aspects of investment which should be considered, including:

- Admissibility of assets

- Restriction on the proportion of certain types of assets

- Custodianship of assets

- Prescription to hold certain assets

- Requirement to hold mismatching reserves

1(ii) *The basic concepts of an asset-liability matching model are*

- Project liability outgo in each future time period

- Project asset proceeds in each future period

- Compare the two for each future period

- Run the comparisons again using different assumptions

- Decide whether the asset proceeds are appropriate for the liability outgo

- If not, investigate alternative asset distributions.

*The inputs required for this modelling are*

- Split of the business into homogeneous groups by nature, term, currency and variability of claims

- Different liability reserves for each homogeneous group including

  - Outstanding claim reserve for the incurred claims....

  - IBNR reserves

  - Unearned premium reserves

  - Unexpired risk reserves

  - Reserve for reopened claims

  - Expense reserves for future claims handling expenses

Payment pattern for each of the above reserves in each of the future periods (monthly or quarterly)

Assets backing the liabilities and free reserves...

...Broken down to different asset classes such as bonds, equities, cash etc.

Premium not yet received from brokers, agents, policyholders etc should also be considered

The reinsurance programme including any future recoverables from reinsurers should be considered

*Assumptions needed for the modelling are*

Growth of business for each LOB

Any seasonality of future premium income

Expected return from the assets held including return on assets backing the free reserves

Dividend payment to the shareholders

Taxation

[16]

- 2(i) As the Catastrophe loss loading is done separately, we need to remove the catastrophe losses from the 2006 experience.

Total number of catastrophe claims in 2006 = 10,000 and total CAT claim amount = 10,000 x 200,000 = 2,000,000,000.

So number of non-catastrophe claims = 3,500 and amount = 200,000,000.

*Calculation table for non-catastrophe experience:*

	Years				Overall
	2005	2006	2007	2008	
(1) Exposure ('000s)	100	150	200	225	675
(2) Number of Claims	2,000	3,500	3,500	4,000	13,000
(3) Amount of Claims ('000s)	110,000	200,000	250,000	350,000	910,000
(4) Period for inflation	5.5	4.5	3.5	2.5	
(5) Inflation adjusted claim amount = (3) x 1.15 <sup>(4)</sup>	237,263	375,120	407,739	496,378	1,516,501

Based on non-catastrophe losses, weighted average frequency is (Sum of number of claims) / (Sum of exposure)

$$= 13,000 / 675,000 = 1.9295\%$$

As new rates are applicable from 1-Jan-2010, on average a policy is sold on 30-Jun-2010 and on average a claim will occur on 31-Dec-2010. So the claim amounts will need to be inflated to 31-Dec-2010. Claims for each of the calendar years can be assumed to have occurred on 30<sup>th</sup> June of that year.

$$\text{Weighted average inflation adjusted claim} = 1,516,501 / 13,000 = 116,654.$$

$$\text{Pure claim cost} = \text{frequency} \times \text{average claim} = 1.9295\% \times 116,654 = 2,247$$

Loading for catastrophe losses = probability of a catastrophic event x probability of a house getting damaged in the event x expected claim amount due to the damage

$$= (1/50) \times 0.1 \times 250,000 = 500.$$

$$\text{Pure claim cost due to all events (non-CAT and CAT)} = 2,247 + 500 = 2,747$$

If P is the final premium, then the equation of value is

$$P = 2,747 + 0.10P + 0.15P + 0.05 * 2,247 + 0.10P + 0.20 \times 0.25P$$

$$P = (2,747 + 112.4) / (1 - 0.10 - 0.15 - 0.10 - 0.05) = 4,766$$

2(ii) *Given full access to the database, analyses can be performed to calculate the pure risk premium and the loading assumptions more accurately:*

The following can be obtained for each policy within each risk group:

Dates on cover

Rating factors and exposure measure details

Details of premiums charged

Also, claims data: relevant dates, payments, estimates, types of claim, types of peril

The past policy coverage may be different in different years. The data need to be adjusted for these policy conditions and impact of any new policy coverage would need to be calculated.

The underwriting process in terms of criteria for accepting and rejecting the proposals might have changed

Methods of distribution might have changed. If the experience of different distribution channels is very different, the analysis might need to be done separately for these channels.

Claim payment patterns might have changed over the years. The current claim payment processes will need to be considered and suitable adjustment to the past data will need to be made.

Accurate claim delay and payment pattern can be estimated based on the past data and suitable adjustment for current claim processes can be incorporated.

The mix of business within personal homeowners' may need to be considered to split the portfolio into homogeneous groups.

The premium rating can be done based on rating factors with the detailed level of data available....

...A GLM approach can be used for rating factor based pricing.

There may be other large claims apart from the claims due to catastrophic events. Suitable adjustments and loadings can be made based on these data.

Claim inflation can be estimated based on own experience.

Expenses analysis for loading can be performed based on the expense details from the finance department.

Activity based expense allocation for the personal homeowners' LOB can be performed.

Expenses can be categorized into fixed per policy and variable and suitable adjustments can be calculated.

#### *Distribution cost*

Average commission for different distribution channels can be analyzed

Overall distribution cost including cost of opening and running branches and salaries of sales managers can be calculated.

If an overall premium rating is done for all channels together then a weighted average distribution cost can be calculated.

#### *Cost of reinsurance*

Cost of reinsurance should be calculated based on analysis of gross and net claims and expected reinsurance arrangements for the next year.

Effect of insurance cycle should be incorporated in estimating the reinsurance cost.

#### *Profit loading*

Expected profit for personal homeowners' should be decided based on shareholder's expectation of overall profit and relative riskiness of this LOB compared to other LOBs.

Effect of insurance cycle and competitors' rates should be considered when deciding on the profit loading.

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### 3(i) (a) **Surplus Reinsurance**

A form of proportional reinsurance where the proportions are determined by the cedant for each individual risk covered by the treaty, subject to limits defined in the treaty.

It will specify the insurer's maximum retention, R. The reinsurer may also require a minimum level of retention, to prevent the insurer from having too little interest in the risk.

It will specify the maximum cover available from the reinsurer. This is expressed as a multiple of R, known as lines of cover, L.

The maximum size of risk that can be placed under the treaty will be  $(1+L)R$ .

### (b) **Reinstatement of an XoL layer**

This is a clause under an XoL treaty by which a layer of protection can be reinstated after the layer has been burnt by losses, usually after payment of an additional premium.

If x% of the layer is exhausted then x% of the reinstatement premium will usually be stated to be payable under the terms of the treaty.

### 3(ii)

	Scenario		
	1	2	3
(1) Sum Insured (R's '000,000)	120	150	300
(2) Claims Amount (R's '000,000)	44	75	200
(3) Surplus Cover Amount = Min (Surplus number of lines covered * Surplus retention, Sum Insured – Surplus Retention) = Min (100, (1) – 50)	70	100	100
(4) Surplus Cover % = Surplus Cover Amount / Sum Insured = (3)/(1)	58.3%	66.7%	33.3%
(5) Surplus Claim Amount = Surplus Cover % * Claim Amount = (4)*(2)	25.7	50.0	66.7
(6) Net Claim after Surplus = (2)-(5)	18.3	25.0	133.3
(7) XoL Retention Amount = Min(Retention of XoL Layer 1, net claim) = Min(20, (6)) = 20	18.3	20.0	20.0
(8) XoL Layer 1 Claim Amount = Min(Net Claim after Surplus – XoL Retention, XoL Layer 1 Limit) = Min[(6)-(7),30]	-	5.0	30.0
(9) Net Claim after Surplus and XoL Layer 1 = Net Claim after Surplus – XoL Retention – XoL Layer 1 Claim	-	-	83.3

	Amount = (6) – (7) – (8)			
(10)	Reinstatement Premium = ‘XoL Layer 1 claim’ as percentage of ‘XoL Layer 1 limit’ times ‘Reinstatement Premium rate %’ times ‘XoL Layer 1 premium’ = (8)/30 x 80% x 1.5	-	0.2	1.2
(11)	XoL Layer 2 Claim Amount = Max(0, Min(Net Claim after Surplus and XoL Layer 1, XoL Layer 2 Limit)) = Max[0, Min[(9),50]]	-	-	50.0
(12)	Net Claim After Surplus and XoL Layer 1 & 2 = (9) – (11)	-	-	33.3
(13)	Total Insurer’s Retention = (12) + (7)	18.3	20.0	53.3

**[13]**

4(i) *Rating factors for commercial motor fleet insurance*

Types of vehicles

Ages of vehicles

Sum insured

Type of goods carried

Location

Past experience

Drivers’ driving experience

Turn over (in case loss of profit cover is bought)

Size of deductible

Level of drivers’ training

Safety standards in the vehicles

4(ii) (a) *Coverage provided*

Damage to own vehicles

*Third party liability*

Property damage

Bodily injury

Loss or damage to goods in transit

Loss of profit after accident of a vehicle

(b) *Perils covered*

Accidents

Theft

Fire

Damage due to harmful substances e.g. chemicals

Floods

Wind Storm

Snow storm

Terrorism

4(iii) *Claim characteristics*

Claim characteristics depend on the types of vehicles in the fleet. The claims from a fleet with only cars will be very different from claims from a fleet which has large trucks and lorries.

*Reporting Delay:*

Claims from a fleet which travels locally will be reported quickly, e.g. a fleet of taxies, usually within a few days.

Claims from a fleet in which vehicles travel large distances might be reported with some delay but mostly within a month.

*Settlement duration:*

Property damage claims from own vehicles will in general be settled within a few months.

Property damage or bodily injury to third parties may take a few years to settle if the case goes to court.

*Claim amount distribution:*

For a homogeneous fleet of cars, the claim amount distribution will be positively skewed. For a homogeneous fleet of large trucks, the claim amount will be negatively skewed.

For a fleet which has a mix of cars and large vehicles, the distribution will be a mixed distribution.

Accumulation of claims: There may be very large claims from a single fleet due to accumulation of vehicles at one location e.g. due to floods.

4(iv) *Examples of exclusions*

Depreciation, wear and tear

Where there is an element of illegality

Losses due to war, riot or civil commotion

Cases of moral hazard e.g. keys are left in the ignition while vehicle is parked

If transit cover not specifically taken then damage to goods being carried in the vehicle is excluded

Damage to the vehicle when the vehicle is in an airport premises

Loss, damage or injury arising out of the operational use of any vehicle as a tool of trade.

When used for non-business related activities

[12]

## 5 (i)

(a) claims experience : claims incurred / earned premiums

(b) total expense levels: expenses and commission / written premiums

(c) overall profitability of writing insurance: insurance profit / earned premiums  
 insurance profit = (underwriting profit + investment income)

(d) financial strength: free reserves / written premiums  
 free reserves = total assets – total liabilities

(e) rate of return on shareholders' capital: total profit / capital employed  
 total profit = insurance profit + investment income from other assets

## 5(ii)

The objective of the reserving exercise

The classes of business, in particular the timing of the run-off of liabilities for these  
 Allowance to be made for latent claims and late reported claims ( IBNR & IBNER)

Rate of inflation

Whether discounting is to be used, and if so, at what rate

Allowance for future expenses

Need for any reserves for re-opened claims

Need for any additional unexpired risk reserve

The extent of margins to be included in the estimates

The extent of variations in the margins between different classes of business

Large claims: inclusion or separate evaluation

Stochastic or deterministic method: prescribed or by choice

Historic data e.g. new company so may need benchmark method

Reliability of outstanding claims data: use of paid or incurred claims for development

5(iii)

A general insurer might choose to use a less conservative basis for estimating claims reserves to boost its apparent profitability or financial strength.

*Reasons for this might be:*

The solvency position would look weak if the reserving basis were conservative

The company desires to enhance the value of the company in the eyes of a potential buyer.

The company may wish to grow the business

5(iv)

A critical factor is the rate of growth.

If company Y is fast expanding its reserves will be increasing leading to lower profit, i.e. to absorb the new business strain

Alternatively, if company X which has a strong reserving basis, is contracting then there will be release of reserves which will produce higher profit

If company Y is in the process of strengthening the reserving basis during the current year then there may be an impact on the current year's profit

In the long term the reserving basis will not affect the total overall underwriting profit which will be the sum of premiums received less claims and expenses paid out

However, if a stronger reserving basis is perceived by prospective policyholders as giving company X greater financial strength this may attract new business and increase long-term profits

Other non-critical factors are Y having higher claims, higher expenses, lower investment income etc

**[14]**

6(i)

*Main headings or topics to be included in the scope of a report on the technical provisions*

Outstanding claims provisions (both gross and net of reinsurance)

Adequacy of liabilities assessed on a funding basis

Provisions for claims handling expenses (both direct and indirect)

Unearned premiums

Provisions for unexpired risks

Claims equalisation provisions

Reinsurance bad debts

A specific disclaimer to the contrary if any of the above items are missing

6(ii) *For each Category of Business*

Recent trends in the business of the insurer

Procedures to assess the reliability of the data

Major events which have taken place after the previous report

Adequacy of premium rates

Expense analysis outcome

Any asset-liability cash flow mismatch and recommendations  
 Appropriateness of reinsurance programmes

Solvency requirement – current and in the near future

[8]

7(i) *Use of functional costing (FC) and timesheet analyses (TSA)*

The first step is to allocate off-line costs suitably either between the line departments or directly to classes. (as in the case of time sheet analysis)

*For example:*

- postal costs might be spread by number of policies in each class
- computer costs by amount of processing and development time
- senior management costs by premium income for each class
- property costs by floor space (and cost per square foot) for the line departments
- personnel and other staff costs by salaries in the line departments.
- *any other valid examples (maximum 1½ overall)*

Now the line department costs (including the costs allocated from above) has to be allocated between the classes. This is done by FC.

FC first attempts to identify the various processes, e.g. a new policy set up, an endorsement, a cancellation, a renewal etc.

FC is the process of monitoring the number of processes carried out by the department for each class, then allocating the department's costs in relation to the number of processes for each class and the relative cost of each task.

In the initial year, a more detailed analysis will be required to ascertain the relative costs of each process for each class.

This might be done by use of timesheets weighted by pay levels according to the seniority of the staff involved.

In all future years these relative costs are used, by reference to the number of processes carried out for each class of business, to split the total expenses for each department.

7(ii) *Splitting expenses, the following points justify splitting costs in this way:*

Management would like to know whether the business is meeting variable costs.

- A contribution to profit and fixed costs must also be made.
- This is particularly important when looking at individual classes of business.

If

the variable costs are not being met by a particular class of business, management would need to examine

areas where control of expenses is needed

whether writing that class should be sustained in the long run.

Variable costs will form the basis for marginal costing minimum premiums.

Total profit for all classes = total contribution - total fixed costs + investment income.

The impact on profitability from changing volumes of business will be more apparent.

[10]

8(i)

Three-year accounting is preferable for classes with high levels of uncertainty persisting after the exposure period has elapsed.

Marine and aviation business is traditionally accounted for using the three-year basis.

Funded accounting is also used when the underwriting year is fundamentally important (as in proportional reinsurance).

8(ii)

Funded accounts are based on premiums *written* in a given year.

The accounts are also known as underwriting-year accounts.

Premiums for policies written in a particular year are kept in a special fund for a period of three years.

The fund is held to cover unexpired risk (at the end of the first year) and outstanding claims.

UPR does not normally feature within funded accounts.

At the end of the third year the profits for that particular block of business are assessed.

(Two or four year accounting periods are also used on the same funded basis.)

Each underwriting year is treated separately until the end of the third year,

*i.e.* the business written in year  $n$  is treated separately until the end of year  $n + 2$ .

A separate fund say ( $F_n$ ) is set up in respect of each underwriting year  $n$ . During accounting years  $n$ ,  $n + 1$  and  $n + 2$  premiums are credited and claims and expenses are debited to this fund

No profit in respect of underwriting year  $n$  is released before the end of year  $n + 2$ , even if the fund is thought to be excessive.

The fund may be augmented by a transfer from reserves if the fund is thought to be inadequate without waiting until the end of the third year.

Such transfers can be repaid, in part or in full, before the end of the third year if it subsequently appears that the transfers were not needed.

At the end of year  $n + 2$  the fund is transferred to the fund balance in respect of earlier underwriting years and reserves (e.g. IBNR and outstanding claims) will be established in respect of all underwriting years  $n$  and earlier. Profits arising from such business is released.

It is usual to continue to measure the results of each underwriting year even though the published accounts will merge the results for the earlier underwriting years.

For a Lloyds syndicate the outstanding liabilities at the end of year  $n + 2$  is transferred to another insurer – normally, the incoming names on the following year of the same syndicate by payment of a premium, the reinsurance to close (RITC) premium

Effectively RITC premium is the same as the reserves required at the year end.

If, there is great uncertainty regarding outstanding liabilities, *i.e.* it is not possible to calculate the RITC premium, the underwriting year is kept open for a further period. At the end of that period a further attempt is made to calculate RITC premium. This process continues until uncertainty has reduced enough to calculate the transfer premium.

[10]

[Total 100 Marks]

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