

# INSTITUTE OF ACTUARIES OF INDIA

## EXAMINATIONS

06<sup>th</sup> May 2016

**Subject ST8 - General Insurance: Pricing**

**Time allowed: Three hours (14.45\* – 18.00 Hrs)**

**Total Marks: 100**

### INSTRUCTIONS TO THE CANDIDATES

- 1) *Please read the instructions on the front page of answer booklet and instructions to examinees sent along with hall ticket carefully and follow without exception*
- 2) *\* You have 15 minutes at the start of the examination in which you are required to read the questions. You are strongly encouraged to use this time for reading only, but notes may be made. You then have three hours to complete the paper.*
- 3) *You must not start writing your answers in the answer sheet until instructed to do so by the supervisor.*
- 4) *The answers are not expected to be any country or jurisdiction specific. However, if examples/illustrations are required for any answer, the country or jurisdiction from which they are drawn should be mentioned.*
- 5) *Attempt all questions, beginning your answer to each question on a separate sheet.*
- 6) *Mark allocations are shown in brackets.*
- 7) *Please check if you have received complete Question Paper and no page is missing. If so, kindly get new set of Question Paper from the Invigilator.*

AT THE END OF THE EXAMINATION

Please return your answer book and this question paper to the supervisor separately.

**Q. 1)** A leading cricketer of the country wants to take an annual insurance coverage for interruption from playing cricket due to illness/injury/accident. The cricketer has approached your company to get a quote for the coverage. The coverage pays a certain amount, mutually agreed by both parties, for every match which the cricketer misses out from playing. The company has asked you to work on the proposal.

i) Outline the main data issues that you are likely to face with regards to pricing this product? (2)

ii) List the various rating factors that you would consider. (3)

[5]

**Q. 2)** The insurance company you are working for is a specialist in aviation insurance. A new airline Company in the country has approached your company for insuring its fleet. You are the pricing actuary and you have been asked to calculate the risk premium for the proposal. Also, you need to provide the 95<sup>th</sup> percentile of the claims distribution.

You have decided to use the frequency-severity approach. Describe the various steps involved in estimating the risk premium and in estimating the 95<sup>th</sup> percentile of the claims distribution. [6]

**Q. 3)** i) A new insurance company plans to launch depreciation shield cover as an add-on to private car motor insurance. The cover will provide protection to policyholder against depreciation of parts in case of a claim. The table for depreciation of parts is given below:

Vehicle Age Band	Depreciation
0-1	10%
1-2	20%
2-3	30%
3-4	40%
>4	50%

You are the actuary of the company and have been asked to estimate the office premium for the product for various age bands. The company also plans to cede 20% of the add-on business under a Quota Share arrangement to the reinsurer. Assume the following:

Claim Frequency: 30%

Claim severity of private car motor own damage before depreciation: INR 20,000

Gross Commission as % of gross premium: 10%

Reinsurance Commission as % of ceded premium: 20%

Management Expenses as % of gross premium: 10%

Profit Margin as % of gross premium: 5%

Stating all other assumptions made and showing all workings, calculate the office premium to be charged for the various age bands. (4)

- ii) It has been observed that for the customers who purchased this add-on, the frequency of claims under private car motor insurance has increased considerably.

Discuss the possible reasons along with the checks you would perform to investigate the increase in frequency.

(4)  
[8]

- Q. 4) i) State the meaning of inuring reinsurance.

(1)

You are given the following exposure curve for a household insurance book of business.

Loss as a % of Insured Value	Cumulative Loss Distribution
10%	25%
20%	39%
30%	50%
40%	60%
50%	68%
60%	76%
70%	83%
80%	88%
90%	93%
100%	97%
120%	100%

You can note that the curve allows for exposure above the insured value to allow for additional living expenses in case of household claims. Answer the following questions assuming that the above exposure curve is fit for purpose.

The company's distribution of risk premium by insured value is also known.

Limit of Insurance	Risk Premium
25,000	250,100
50,000	167,000
100,000	324,300
250,000	125,750
333,000	51,000
500,000	64,000

- ii) This primary insurer obtains a property per-risk excess of loss reinsurance treaty. Calculate, showing all workings, for each limit of insurance, the risk premium for the layer covering \$200,000 in excess of \$100,000, assuming there is no inuring reinsurance.

(4)

- iii) Now assume that a surplus-share reinsurance treaty with a retained line of \$300,000 inures to the benefit of the property per-risk excess of loss reinsurance treaty. Calculate, showing all workings, for each limit of insurance, the revised risk premium for the per-risk excess of loss reinsurance treaty. Use linear interpolation on the given exposure curve, where necessary. (3)  
[8]

**Q. 5)** As an actuary of a leading general insurance company, you have been asked to estimate the risk premium for a retail health product. You plan to build a Generalized Linear Model (GLM) to estimate the risk premium by modeling frequency and severity.

- i) State the items you would consider to decide the accident period that should be selected for modeling. (3)
- ii) Outline the various checks to analyze the significance of a factor used in the model. (5)
- iii) There are 200 levels of sum insured defined in the model. Comment on why parameter smoothing for this rating factor is required in the severity model. (1)  
[9]

**Q. 6)** Currently there is a regulatory tariff premium for motor third party product based on various vehicle segments. The regulator has decided to de-tariff the product premium and has asked all insurance companies to file the premium.

- i) Discuss the possible challenges that various insurance companies will face while pricing the product. (7)
- ii) It is found that the risk premium varies considerably from one location to another. State the possible reasons for location to be a significant rating factor. (4)  
[11]

**Q. 7)** A leading reinsurer has been asked to provide catastrophe reinsurance cover for the property book of a large insurer.

- i) State the key factors that the reinsurer would consider while considering the risk of this book of business. (5)
- ii) The reinsurer has decided to use in-house catastrophe model to estimate the premium.
- a) List the data items which the reinsurer requires from insurer for pricing. (3)
- b) The OEP/AEP curves suggested by the reinsurer are very different from the ones provided to the insurer by other reinsurers. Given the data provided to each reinsurer by the insurer is same, discuss the reasons for the differences between the curves among various reinsurers. (3)  
[11]

- Q. 8)** You are an independent pricing consultant and have recently taken up an assignment with a general insurer specializing in commercial lines of business. You have so far worked with personal lines insurers only. The company management has indicated about data quality challenges upfront.
- i)** Apart from the inherent complexity in commercial lines business as compared to personal lines, discuss the possible reasons for data quality issues in commercial insurance. (5)
  - ii)** The company has taken over another similar company recently. You are expected to set up a system of regular monitoring of the acquired book of business. Outline the key features of a good system for monitoring business. (6)
- Q. 9)** You are the Pricing Actuary working for a medium sized general insurance company, which has been selling Extended Warranty product (vehicles, as well as household appliances) for a number of years. You have been asked to study the experience, Company had on this product and also to analyze the issues and challenges in pricing it appropriately. [11]
- i)** In order to ensure accuracy in pricing of its vehicle extended warranty book, you have decided to carry out a rate adequacy study on the block of business under consideration. Discuss the areas specific to this product where you would like to pay special attention in your study. (5)
  - ii)** Assume a vehicle extended warranty contract is sold for a new vehicle for 6 years and 72,000 miles for a vehicle with a 3 years and 36,000 miles manufacturer's warranty. Inflation rate is 3% per annum and assume that the claim frequency will increase by 4% year on year. Determine how the premium will be earned over the policy period assuming that the vehicle is driven 15,000 miles/year. Clearly state any assumptions. (5)
  - iii)** Identify the key issue with this approach. (1)
  - iv)** During last financial year your company got business from a Third Party Administrator (TPA) who administers warranty program for electronic appliances and wanted to transfer the warranty risk to an insurer. While doing that, your company decided to quote a same fixed premium per contract regardless of the appliance.

The following is the details of the contracts under the program initially.

<b>Appliance</b>	<b>Number of contracts</b>	<b>Loss cost per contract (in INR)</b>
Television	1,200	7,500
Refrigerator	2,000	10,000
Microwave	600	5,000

Expected loss ratio is 67% at which the contract was originally priced.

Subsequent to this arrangement, the TPA wrote a new account which only sells refrigerators (1000 new contracts are written) and these will also be insured under the same program by the insurance company.

Using the information above, discuss the issue your company is facing as a result of the pricing.

(4)

**[15]**

- Q. 10) i)** A large general insurance company in a developing country is trying to make a foot-print into the crop insurance sector which is severely under-penetrated.

Discuss the two types of coverage under crop insurance contract – a) indexed based and b) indemnity based.

(4)

- ii)** List down the various influencing factors of crop insurance product design. (4)

- iii)** You work in the pricing of personal line business in this company. Your colleague, who does not have much exposure in personal line, has heard about the use of “Spatial Smoothing” method of classification in motor insurance. He wants to incorporate some form of credibility method in crop insurance pricing and hence he approached you to know more about spatial smoothing.

- a)** Define spatial smoothing. (1)

- b)** Define the two forms of spatial smoothing and suggest which one is often employed for weather related perils. (4)

- iv)** Basis risk in crop insurance arises when claim payments are greater or lesser than the actual losses suffered. Comment on which of the two types of coverage is more prone to the basis risk and why. Also comment on the moral hazard with this type of cover. (3)

**[16]**