

# Actuarial Society of India

## EXAMINATIONS

30<sup>th</sup> October 2006

Subject SA5 – Finance

Specialist Applications

Time allowed: Three Hours (10.15\*am – 1.30 pm)

### *INSTRUCTIONS TO THE CANDIDATE*

1. *Do not write your name anywhere on the answer scripts. You have to write only your Candidate Number on every answer script.*
2. *You have 15 minutes at the start of the examination in which to read the questions. You are strongly encouraged to use this time for reading only. But notes may be made. You have then three hours to complete the paper.*
3. *Mark allocations are shown in brackets.*
4. *You must not start writing your answers in the answer papers until instructed to do so by the Supervisor.*
5. *Attempt all questions, beginning your answer to each question on a separate sheet.*
6. *Fasten your answer sheets together in the numerical order of the questions.*
7. *The answers are expected to be India Specific application for the syllabus and corresponding core reading. However, substantially the core reading material is still taken from material supplied by Actuarial Education Company which are meant for UK Fellowship examination. The core reading also contains some material which is India Specific, mostly the IRDA regulation. In view of this, it should be noted that focal point of answers is expected to be India Specific application. However if application specific to any other country is quoted in the answer the same should answer the question with reference to Indian environment.*
8. *In addition to this paper you should have available Actuarial Tables and your own calculator.*

#### **Professional Conduct:**

“It is brought to your notice that in accordance with provisions contained in the Professional Conduct Standards, If any candidate is found copying or involved in any other form of malpractice, during or in connection with the examination, Disciplinary action will be taken against the candidate which may include expulsion or suspension from the membership of ASI.”

Candidates are advised that a reasonable standard of handwriting legibility is expected by the examiners and that candidates may be penalized if undue effort is required by the examiners to interpret scripts.

#### ***AT THE END OF THE EXAMINATION***

*Hand in BOTH your answer script and this question paper to the supervisor.*

- Q.1)** Define the following:
- Maturity gap
  - Market risk
  - Litigation risk
  - Compliance risk
- [5]**

- Q.2)** ABC bank offers 3-year personal loans. The bank has issued equity and takes fixed-term deposits. The balance sheet, as on March 2005, is as follows:

<i>Assets</i>	<i>(Rs. Crore)</i>
3-year personal loans @12% fixed	500
<i>Liabilities</i>	
4-year deposits @8% fixed	400
Equity	<u>100</u>
	500

Assuming that the bank has only just started trading and ignoring any future new loans or deposits, calculate:

- the net interest income in each of the first 3 years. (2)
  - the duration of the bank's assets and liabilities and the implied duration of equity. In each case, use a discount rate of 8% and assume that all cash flows occur at the end of the year. (2)
  - the value of equity shares by discounting all income and outgo using an 8% discount rate. (2)
  - The expected change in the value of the equity shares arising from 0.5% increase in interest rates? (2)
- [8]**
- Q.3)** Agarwal & Company has historical gross annual revenue distribution with mean Rs.5,000 crore and standard deviation of Rs.500 crore. Fixed costs amount to Rs.2,000 crore and variable are 5% of gross revenue. Tax is a simple 15% of revenue less costs.
- If the company were targeting EAR using a 99% confidence interval (*i.e.*, 1/2 % tail on two sides, or 2.57 standard deviations) how much risk capital would be required and what would be the earnings at risk? (5)
  - Briefly explain how might we go about analyzing market risk, credit risk and operational risk and what types of distributions might be exhibited by the losses arising from each of the three risk areas? (5)
- [10]**

**Q.4)**

- (a) i) What are the characteristics of operation risk that make it hard to estimate? (2)
- ii) Given these challenges, suggest pragmatic ways of quantifying operational risk. (3)
- (b) Value at risk and stress testing are two methods of assessing downside risk. Discuss how the two measures differ and the advantages and disadvantages of each. (5)
- [10]**

**Q.5)**

- (a) You are investment adviser to ABC Company. The Managing Director has asked you a brief note on 'duration of the equity' of your company. Prepare a brief note explaining the concept. (3)
- (b) Assuming that the equity shares of your company have positive value, what is required for the duration of equity to be zero? Is it good or bad for the company? (3)
- (c) How might a bank go about achieving zero equity duration and what problems might it face. (5)
- [11]**

**Q.6)** XYZ is a general insurance company which holds a 7% unsecured loan stock 2012 issued by ABC Ltd., which currently has a market price of 100. KLM is a life insurance company which holds 5.2% preference shares in ABC Ltd. maturing in 2012, which are currently priced at 100.

- (i) Show how the two insurance companies could both gain by trading these securities between themselves. (4)
- (ii) List the other issues that the companies should consider before making the exchange. (2)
- [6]**

**Q.7)** You are a Consulting Actuary and your forte is Financial Risk Management. Your services have been sought by Get Mortgage Bank (GMB), a small regional bank with a history of mortgage lending to individuals in the local community. In the recent years GMB has been trying to diversify both its loan portfolio and its funding mix. Your remit is to review selected aspects of the asset/ liability management of the bank. You have been provided with the balance sheet of GMB as on March 31, 2006 with the following additional information:

**Balance Sheet as on March 31, 2006**

<b>Liabilities</b>	<b>(Rs. in million)</b>	<b>Assets</b>	<b>(Rs. in million)</b>
Share Capital	90	Long Term Government Bonds	500
Reserves	90	Treasury Bills	705
Series A Long Term Bonds	700	Mortgage Lending	3645
Series B Long Term Bonds	700	Corporate Lending	1620
Current Deposits	5700	Inter Bank Lending	1630
90 day Term Deposits (with instant access)	820		
<b>Total</b>	<b>8100</b>	<b>Total</b>	<b>8100</b>

**Additional Information:****A. On the Assets side:**

1. "Mortgage" lending has been mostly to individuals in the local community. Most of these mortgages have an original term of 20 years and many of them have interest rates that are fixed for periods of 5 years at a time.
2. "Corporate lending" refers to the lending to local businesses on a floating rate basis with terms varying between 3 and 5 years. Many of these local businesses are involved in the high end IT (Information Technology) industry
3. "Inter Bank Lending" refers to the lending to other banks on various terms and in various currencies.

**B. On the Liabilities side**

4. "Series A Long Term Bonds" refers to the "callable" bonds issued by the bank on 1<sup>st</sup> January 2006. These are 20 year bonds that pay annual 8% coupons until 1<sup>st</sup> January 2026. These bonds are callable between 2011 and 2026.
5. "Series B Long Term Bonds" refer to the "puttable" bonds issued by the bank on 1<sup>st</sup> January 2006. These bonds pay annual 7% coupons until 1<sup>st</sup> January 2026. These bonds are puttable between 2011 and 2026.
6. As on the balance sheet date, both Series A and Series B bonds stand in the market at a dirty price of approximately par and the gilt yield curve is flat at 5.5% pa

**C. General Information:**

GMB has recently designed an internal model to estimate the economic capital that it has to hold against credit risk. This model has been developed in response to Basel II proposals. Under this model, each loan is ascribed an annual probability of default, which is derived through an internal analysis of the financial statements of the borrower(s). The model also accepts correlations between risks such that the correlation between the default of one corporate loan and that of another is estimated and particular care is taken to ensure that correlation within sectors is high. The model then predicts, using multiple simulations, the likely default experience over the next 12 months, which then allows the bank to estimate the capital it should hold against such risks.

- (a) Describe the interest rate and currency risks that the bank faces and suggest how this can be reduced by using swaps and futures. (10)
- (b) (i) Describe the concentration of credit risk that exists in the bank's balance sheet (2)
- (ii) Discuss how this could be reduced using
- ? Securitization (3)
  - ? Credit Derivatives (8)
- (c) (i) Define the term "economic capital" (1)
- (ii) Discuss the limitations of the internal model developed by the bank. (7)
- (d) The CRO (Chief Risk Officer) of the bank believes that interest rates are likely to be volatile in the coming years. Hence she is concerned that the bank may have to refinance one or both of the bonds [Series A and Series B bonds] in 2011 and has sought your advice on the matter. The CRO has done some calculations and she has come up with the following table of results:

Bond	Puttable 7% 2026	Callable 7% 2026
(i) Market Price	100	100
(ii) Price of equivalent bonds without the embedded options (i.e., price of uncallable/unputtable 20 year bond)	94.9	105.1
(iii) Mc Caulay duration of Uncallable/unputtable 20 year Bond	11.1	10.8
(iv) Mc Caulay duration of uncallable/unputtable 5 year bond	4.38	4.32
(v) Option Adjusted Spread (OAS)	3.4	3.7
(vi) Estimated change in price of bond if uncallable/ unputtable bond yields rise (or fall) by 0.1%	0.55 per 100 nominal	0.43 per 100 nominal

- (i) Define the term "OAS". Describe what it represents and how it would have been calculated in practice. Your answer needs to have a reference to the actual OAS of the two bonds. (7)
- (ii) Calculate the values of the options embedded in Series A and Series B bonds. State assumptions, if any. (2)
- (iii) Calculate the effective durations of Series A and Series B bonds. Explain why the effective duration of the callable bonds (series A) differs from the Mc Caulay Duration of the 20 year bond without this embedded option. (3)

(iv) Draft a report to the CRO of the bank regarding the two bond series. In your report, you should cover the following points:

- ? The circumstances under which the bank may have to refinance the bonds [Series A and Series B] early (4)
- ? The strategy which the bank could adopt in the derivative markets to hedge the risk of early repayment. You can assume that it is not possible to restructure the two existing bonds. (3)

**[50]**

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