November, 2015  MATHEMATICAL BASIS OF LIFE ASSURANCE

[Time : 3 Hours]

Answer ANY FIVE questions only. All questions carry 20 marks each.
(Candidates are allowed to refer handbook on Formulae and Tables).

Q.1 You as an actuary of a medium sized Indian life insurer with limited capital which has been writing increasing volumes of new business for the past few years. The company has grown rapidly by opening new branches and recruiting and training large number of advisors. The insurer has been selling its products through Tied Agency, Bancassurance and Broker channels of distribution.

You are reviewing the results for the year ended 31 March, 2015. Premium income has increased by 289%, compared to 150% assumed in the 2014-15 business plan. During the year growth has been financed from surplus without the need for fresh capital but the solvency position has deteriorated.

In a discussion with the Marketing Director you have expressed concern about the rapid growth in the volume of business, the deteriorating solvency position and the risks associated with these. The marketing Director has sought a detailed note on these to be discussed in the next risk committee meeting.

a) Discuss how New Business Volume can be a source of risk,
b) Discuss how Mix of New Business can be a source of risk,
c) Discuss how management actions can be a source of risk,
d) Discuss how management expenses can be a source of risk to the insurer.

Q.2

a) Write Notes on Unit Linked Policies 5
b) Explain with reasons the following: 5
   i) Surrender value is not offered under an immediate annuity payable during the life time of an annuitant.
   ii) Term Assurance Policy costs less than an endowment policy or a whole life policy.

   c) Calculate office single premium under two year temporary assurance policy with sum assured of Rs.200000/= on a life aged 40. Provide for expenses at 10% of single premium and 0.3 per thousand sum assured. Basis IALM (94-96) modified ultimate Mortality Table and 6% interest.

   d) Find the net premium policy value at 6% interest of a Whole life policy for Rs.80000/= effected at age 35 which has been in force for 15 years and to which a reversionary bonus of Rs.21600 is attached. It is given that \( P_{35} = .00983 \) and \( P_{50} = .02351 \)
Q.3 On 1 January 2010, a life insurance company issued 1,000 ten year term assurance policies to lives aged 50 exact. For each policy, the sum assured is Rs 100,000 for the first five years and Rs 50,000 thereafter. The sum assured is payable immediately on death and level annual premiums are payable in advance throughout the term of this policy or until earlier death.

The insurer uses the following basis for calculating premiums and reserves: Mortality IALM (94-96) modified ultimate, Interest 6% per annum and nil Expenses.

a) Calculate the net premium retrospective reserve per policy as at 31 December 2014. 8
b) i) Explain the answer arrived at in the above question (a) 2
    ii) Describe the main disadvantage to the insurance company of issuing this policy. 4

There were 20 deaths during the years 2010 to 2013 both inclusive and further 8 deaths in the year 2014.

c) Calculate the mortality profit or loss to the life company during 2014. 6

Q.4 a) Define Asset Share of a life insurance policy. 2
b) List the components that may be used to determine the asset share of a policy. 3
c) Describe the following while working out Asset Share of a life insurance policy:
   i) Surplus from without-profit business 2 each
   ii) Surplus arising from surrenders
   iii) Allocation from the estate

d) A with-profit regular premium endowment policy has been issued on 1st January 2012 with premiums of Rs 20,000/- per annum paid annually and sum assured Rs 1,00,000.
The actual experience of the life office during next three years is as under:

<table>
<thead>
<tr>
<th>Year</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment return (%)</td>
<td>9.4</td>
<td>8.8</td>
<td>8.1</td>
</tr>
<tr>
<td>Mortality (per thousand)</td>
<td>2.2</td>
<td>2.4</td>
<td>2.6</td>
</tr>
<tr>
<td>Expenses (Rs)</td>
<td>5,500</td>
<td>400</td>
<td>425</td>
</tr>
</tbody>
</table>

You may assume net effect from other sources of surplus as well as charges for use of capital to be nil.
Calculate the asset share of the policy at the end of year 2014:

i) assuming that expenses are incurred at the beginning of policy year while claims are paid at the end of the year. 5
ii) assuming that expenses are incurred at the end of policy year and claims are also paid at the end of the year. 4
Q.5  
   a) Discuss various considerations in allowing surrender of a policy. 
   b) Discuss the effect of surrenders on future profits and policy reserves.  
   c) Discuss various principles involved in allowing alterations under a life insurance Policy. 
   d) A person now aged 45 had purchased a Whole Life Assurance policy 15 years ago for Rs 50,000 sum assured under which annual premiums at Rs 400 are payable for maximum of 40 years. He now desires to alter the policy into Endowment Assurance maturing at age 65 and premiums ceasing at age 60 or on death, if earlier. Calculate the revised annual premium payable on alteration on the basis of IALM (94-96) modified ultimate table at 6%. Ignore expenses.

Q.6  
   a) A medium size life insurance company has written individual term assurance business for many years. In the past a very small proportion of this business has been reinsured by the life company.  
      i) Discuss the reasons why the life insurance company might have reinsured some of its business.  
      ii) Discuss why the life insurance company may be willing to reinsure a greater proportion of its new term assurance business in the future. 

   b) The insurer has the following reinsurance arrangements: 
      Rs.130,000 in excess of Rs. 50,000  
      Rs. 300,000 in excess of Rs. 150,000  
      Rs. 20,000,000 in excess of Rs. 500,000  
      (i) Comment on the problem with each of the above reinsurance arrangement?  
      (ii) How much will the life insurance company be able to recover from the reinsurer in respect each of the following claims? 
         A. Rs 70,000  
         B. Rs 250,000  
         C. Rs 4,000,000  
         D. Rs 700,000  
         E. Rs 50,000

Q.7  
   a) List out the items that comprise the policy wise data for valuation. 
   b) Write short notes on.  
      i) Valuation of Unit linked policies  
      ii) Exchange Fluctuation Reserve  
      iii) Provision for expenses in respect of reduced paid up policies

Q.8  
   a) An impaired life aged 35 wishes to effect an Endowment Assurance without profits for a sum assured of Rs.100000/- for a term of 20 years. The life office assumes that he is subject to mortality equivalent to that of a normal life aged 40.
i) Calculate the extra annual premium
ii) Calculate the alternative debt that should be charged reducing by a uniform amount every year so that the debt extinguishes at the end of 10 years.
   Basis: IALM (94-96) Modified Ultimate and 6% Interest. Ignore Expenses

b) i) Calculate the quarterly instalment of an immediate annuity payable in arrear for a person aged 52 years for 15 years certain and thereafter for life. The single premium for the annuity works out to Rs. 25000 after providing for expenses at 15 per thousand single premium and 4% of the annuity instalments.
   Basis: LIC (a) 96-98 ultimate tables and 8% interest
ii) Write short notes on select premiums

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