May, 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

a) Calculate the net annual premium ceasing after 15 years or on previous death on the following money back policy with following benefits for a life aged 45 years: (assume death benefit is payable at the end of year of death)
   i) Rs. 25000 on survival to the end of 5 years
   ii) Rs. 25000 on survival to the end of 10 years
   iii) Rs.50000 on survival to the end of 15 years
   iv) Rs.100000 on death at any time during the 15 years

   Basis: IALM (94-96) Modified Ultimate mortality table and 6% interest.

   Marks
   5

b) Calculate the net annual premium payable throughout life under a whole life assurance of Rs.50000 on a life aged 45 years where the death benefit is payable immediately on death. Basis: IALM (94-96) modified Ultimate Table and 6% interest

   Marks
   5

c) Calculate Office annual premium for an Endowment Assurance for Rs.25000 to a person aged 40 for 15 years. Provide for initial expenses at 25 per thousand sum assured, other expenses at 10 per cent of all premiums and constant expenses of 5 per thousand sum assured. Basis: IALM (94-96) modified Ultimate Table and 6% interest

   Marks
   5

d) Calculate the office single premium for an Immediate Annuity of Rs.6000 per annum payable monthly for 10 years certain and thereafter for life to a person aged 55. Provide for initial expenses at Rs.10 per thousand single premium and 2 percent of annuity payments. Basis: LIC (a) (96-98) Ultimate Table and 8 % interest

   Marks
   5

Q.2

a) i) What is / are the Basic Risk(s) faced by a Human Life?
ii) Which is / are the Basic Life Assurance Product(s) to provide Protection against these Basic Risk(s)?
   iii) In which of the Life Assurance Product(s), a Claim is Definitely Payable? Why?

   Marks
   3

   4

   3

b) Write a Short-Note on ‘With-Profits Life Assurance Product’.

   Marks
   5

c) Explain, in Brief, the Ways, in which, a Life-Assured can ‘Participate’ in the Profits of Life Assurance Company.

   Marks
   5
Q.3  

a) Write a Short-Note on 'Consistency of Premiums'.

b) Calculate Office Single Premium and Office Annual Premium for an Immediate Life Annuity, of Rupees 12,000/- per Annum, Payable Quarterly, Deferred by 10 Years from Now, for a Person of Present Age of 40 Years; considering Initial Expenses of Rupees 5% of Single Premium and First-Year Expenses of 25% and Subsequent-Year Expenses of 2.5% of Annual Premium; and Annuity Expenses of 5% of Annuity Payments. Basis: L.I.C. (a) Ultimate Table and 8% Interest.

Q.4  

a) i) Derive the relationship between policy values in successive years in respect of a whole life policy.

ii) Explain briefly in words what does the above relationship indicate

b) Give expressions for the retrospective policy value and prospective policy value at the end 25 years under a whole life Policy for a sum assured of Rs. 30000 effected on the life of a person aged 35 years. Annual premiums under the policy were limited to 20 years. Show that the two expressions are equal. Ignore expenses.

c) State mathematical expressions for the paid up value in terms of annual premium chargeable as well as the assurance payable on the following, clearly giving the details of notations. (State two expressions for each type of policy)

i) A whole life policy

ii) An n year Endowment assurance policy

Q.5  

a) Calculate Net Premium Policy Value, at 6% Interest, of a Special Endowment Assurance, for a Term of 35 Years, with Yearly Guaranteed Addition of Rupees 75% Sum-Assured, for a Sum-Assured of Rupees 1 Crore, bought by a Person, at the Age of 25 Years, 25 Years ago. Basis: Indian Assured Lives Mortality (I.A.L.M.) (1994-1996) (Modified) Ultimate 4% Interest

b) Write a Short Note on 'Alteration of Policy Contracts'.

c) Write a Short Note on 'Adequacy of Premiums'.

Q.6  

a) Briefly describe the methods of allowing for an extra risk in life insurance and briefly explain the relationship between the two methods.

b) A policyholder effected at age 35 an Endowment Assurance Policy by annual premiums for 30 years. Immediately before the due date of the 21st Premium he has requested for alteration of the policy to mature at age 60. On the assumption that the office calculates premiums and maintains reserves on the basis of the IALM (94-96) modified Ultimate table at 6% find the revised annual premium per Rs.1000 sum assured. Ignore Expenses.
c) Write short Notes on
   i) Market Value Risk
   ii) Interest Rate Risk
   iii) Withdrawal Risk

Q.7 a) On 1st January, 2011, a Life Assurance Company issued a Group of Endowment Assurance Policies, Each with a Sum-Assured of Rupees 10 Lakhs, and an Annual Premium of Rupees 50,000/-.

Data related to Mortality (Claims are Paid at the End of the Year), Interest (Earned at the End of the Year), and Expenses (Incurred at the Start of the Year, at the Time of Premium-Payment), are as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Mortality (%)</th>
<th>Interest (per Annum)</th>
<th>Expenses (Rupees, 000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>0.076</td>
<td>0.063</td>
<td>51</td>
</tr>
<tr>
<td>2012</td>
<td>0.078</td>
<td>0.059</td>
<td>4</td>
</tr>
<tr>
<td>2013</td>
<td>0.048</td>
<td>0.092</td>
<td>3</td>
</tr>
<tr>
<td>2014</td>
<td>0.087</td>
<td>0.081</td>
<td>2</td>
</tr>
<tr>
<td>2015</td>
<td>0.079</td>
<td>0.066</td>
<td>2</td>
</tr>
</tbody>
</table>

Calculate the Asset Share per In-Force Policy, at the End of Each of the 5 Years, ignoring All Other Components, contributing to the Asset Share Cash-Flows.

b) Describe the Effect of Surrenders on Future Profits and Policy Reserves

Q.8 On 1st January 1999 an office issued a number of annual premium without profit policies to a group of lives each of who was then aged 35. All the policies were for a term of 20 years and were of the following types:
   i) Endowment Assurances under which the sum assured was payable on survival to the end of the term or on previous death.
   ii) Temporary assurances under which the sum assured was payable only death within the policy term.

Calculate the profit or loss from mortality for the calendar year 2008 in respect of the policies issued to this group of lives given the following data:

<table>
<thead>
<tr>
<th>Type of Policy</th>
<th>Sum Assured existing as on 31st December 2008</th>
<th>Sum Assured Discontinued by death during 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endowment Assurance</td>
<td>Rs.2700000</td>
<td>Rs.17000</td>
</tr>
<tr>
<td>Temporary Assurance</td>
<td>Rs.1540000</td>
<td>Rs.4000</td>
</tr>
</tbody>
</table>

END