### Question 1 (Q.1)

a) Calculate the office single premium for an Immediate Annuity of Rs. 7200 per annum payable monthly for 10 years certain and thereafter for life to a person aged 55. Provide for initial expenses at Rs. 5 per thousand single premium and 3% of annuity payments.

Basis: LIC (a) (1996-98) Ultimate Table and 8% interest.

b) Calculate office single premium under a 2-year Temporary Assurance for sum assured of Rs. 1,00,000/- on (40). Provide for expenses at 6% of single premium and 2% sum assured.

Basis: IALM (1994-96) Modified Ultimate Mortality Table and 6% interest.

c) A sub-standard life aged 40 effects and Endowment Assurance for Rs. 50,000/- for a term of 25 years. The office has decided to accept the risk by charging extra premium calculated on the basis of rating up of age by 5 years for the first 6 years, by 3 years for the next 8 years and by 2 years thereafter. Calculate the extra annual premium.

Basis: IALM (1994-96) Modified Ultimate Table and 6% interest. Ignore expenses.

**Marks:** 6

### Question 2 (Q.2)

a) State the conditions necessary for the Prospective Policy Value and the Retrospective value to be the same.

**Marks:** 4

b) Give expressions for the prospective policy value and retrospective policy value at the end of 10 years under an Endowment Assurance Policy, for a sum assured of Rs. 50,000/-, effected on the life of a person at age 35 and term of 25 years. Annual premiums under the policy are limited to 15 years. Show that the two expressions are equal. Ignore expenses.

**Marks:** 9

c) By paying a single premium a temporary annuity of Rs. 50,000/- p.a. payable quarterly in arrears for a term of 10 years was purchased one year ago by a policyholder on his 60th birthday. Show algebraically that the current retrospective and prospective policy value are equal. Ignore expenses. State assumptions, if any.

**Marks:** 7

### Question 3 (Q.3)

a) Write a Short Note on ‘Modified Net Premium Method of Valuation’.

**Marks:** 5

b) Consider a Whole-Life Assurance for Sum-Assured of Rupees 1 Crore, to a Person of Age of 30 Years. Tabulate the Net Premium Policy Value(s) and Modified Net Premium Policy Value(s) for the durations 1 years to 15 years.

Basis: IALM (1994-96) (Modified) Ultimate Mortality and 6% interest.

**Marks:** 15
Q.4  
  
  a) Calculate office yearly premium, to be paid by a person whose present age is 35 years, for a Term Assurance and an Endowment Assurance, all for a Term of 25 years, all for a Sum-Assured of Rupees 1 Crore each, considering the Insurer’s Initial Expenses as 15% of premium and 1.5% of Sum-Assured, and the Insurer’s Renewal Expenses as 5% of premium and 0.5% of Sum-Assured, a Constant Contingency-Loading of 3% of Sum-Assured, a Bonus Loading of 2% of Sum-Assured applicable under Endowment Assurance.

b) What will be the Amount(s), that are required to be paid by the Policy-Holder, in (a) above, if the mode opted is Half-Yearly.

Basis : IALM (1994-96) (Modified) Ultimate Mortality and 6% interest.

Q.5  

a) What do you mean by ‘Profit’ and ‘Surplus’ in Life Assurance Business?  
b) Write a Note on ‘Sources of Surplus’.  
c) Enumerate ‘Special Reserves and Adjustments’.

Q.6  

a) A Sub-Standard Life of Present age of 30 years, has proposed for an Endowment Assurance (With-Profits), for a Sum-Assured of Rupees 10 crores, for a Term of 30 years. The Life office assume that the proposer is subject to Mortality equivalent to that of a Standard Life of Present Age of 40 years.

i) What is the Extra Annual Premium Rate?

ii) What is the Extra Annual Premium Amount?

iii) What is the Alternative Debt that should be charged, reducing by a Uniform Amount, Every year, so that the Debt extinguished at the End of 20 years?

b) Calculate the Net Premium Policy Value, at 6% Interest, of a Whole-life (with profits) Assurance of Sum Assured of Rupees 1 crore, effected on the Life of a person at the age of 30 years, before 20 years, and to which, a Reversionary Bonus of rupees 10 Lacks is attached.

c) Write a Short-Note on ‘Valuation of Unit-Linked Policies’.

Basis : IALM (1994-96) (Modified) Ultimate Mortality and 6% interest.

Q.7  

The policy value at the end of t years in case of a Whole Life Policy and an Endowment Assurance Policy respectively are given by

\[ V_x = A_{x+t} - P_x \bar{a}_{x+t} \quad \text{and} \quad V_{x:n} = A_{x+t:n-t} - P_{x:n} \bar{a}_{x+t:n-t} \]

Starting with these expressions derive the following relationships

(i) \( V_x = 1 - \left( \frac{\bar{a}_{x+t}}{\bar{a}_x} \right) \)

(ii) \( V_{x:n} = 1 - \frac{\bar{a}_{x+t:n-t}}{\bar{a}_{x:n}} \)

(iii) A person now aged 30 bought a Whole Life Assurance Policy for Rs.50,000 sum assured 10 years ago. He now desires the policy to be
altered to an Endowment Assurance Policy maturing at age 60. The basis is IALM (1994-96) (modified) Ultimate mortality with 6% interest.

a) If the policyholder desires reduction in sum assured, keeping the premium payable as per the original contract unaltered, calculate the reduced sum assured. The basis is IALM (94-96) (modified) Ultimate mortality with 6% interest.

b) If the policyholder desires the altered policy for the same sum assured find the net annual premium he has now to pay.

Q.8

a) Assuming that the sum assured is payable at the end of the year of death describe, including formulae, the following expressions
i) Death strain at risk 2
ii) Expected death strain 2
iii) Actual death strain 2

b) On 1st January 2004, the life company sold 10,000 term assurance policies each with Rs.50,000/- sum assured and term 25 years to lives then aged 40 exact and 20,000 endowment assurance policies each with Rs. 1,00,000 sum assured and term 25 years to lives then aged 35 exact. The premiums are payable annually in advance and the death benefit is payable at the end of year of death.

During the first ten years, there were 150 actual deaths from the term assurance policies written and 250 actual deaths from the endowment assurance policies written.

i) Calculate the death strain at risk for each type of policy during 2014.

During 2014, there were 25 actual deaths from the term assurance policies and 40 actual deaths from the endowment assurance policies.

ii) Calculate the total mortality profit or loss to the office in the year 2014.

The basis is IALM (1994-96) (Modified) Ultimate Mortality with 6% interest. Ignore expenses.

END