ASSOCIATESHIP/FELLOWSHIP EXAMINATION
FOUNDATION OF ACTUARIAL SCIENCE
(LIFE INSURANCE)

[Time : 3 Hours] [Total Marks:100]

Answer EIGHT questions only. Question number 10 is compulsory which carries 16 marks
Any SEVEN questions from Q.No.1 to Q.No.9 which carries 12 marks each.
(Candidates are allowed to refer Handbook on Formulae and Tables)

 Marks

Q.1 Write short notes on:
   a) Life year Method,
   b) Calendar year Method.
   c) Policy year Method.
   d) Census Method.
   3 each

Q.2 Answer any three of the following:
   a) What is meant by Central Death Rate (m_x)? Derive relation between m_x and q_x.
   b) A person has purchased a bond of the face value of ₹100/- on which interest is payable yearly at 4%. He received in all three interest payments, the first one falling due one year after purchase. At the end of three years, the bond has matured for payment at par. If the person has realised an interest yield of 5% p.a. in the transaction, what is the purchase price?
   c) Distinguish between:
      Money weighted rate of return and time weighted rate of return.
   d) Write a short note on ‘graduation’.
   4 each

Q.3. The following particulars are given:
   x  25  26  27  28  29  30
   lx 97380 97088 96794 96496 96194 95887
   dx 292 294 298 302 307 313

   Calculate ignoring interest and expenses:
   a) The value of Temporary Assurance of ₹1000/- for 2 years for a person aged 25.
   b) The value of Endowment Assurance Benefit of ₹1000/- for 4 years to a person aged 25.
   c) The value of a Pure Endowment of ₹600/- for a person aged 27 receivable on attaining age 30.
   d) Write commutation functions for above mentioned benefits.
   3 each

Q.4. It is proposed to investigate the mortality experience of a large life office. The following suggestions are made to carry out the investigation. Comment on the suggestions.
   a) All the policies effected by the life office may be included in the investigation.
   b) The policies need not be segregated into classes of insurance for investigation.
   c) The period of investigation may be 25 years.
   4 each
Q.5 Answer any two of the following:

a) Write short note on exposed to risk.

b) Establish following relationship mathematically -

\( (1 \bar{a})_x = \frac{\bar{a}_x - \text{nv}_x}{d} \)

c) \( e_x^n = e_x + \frac{1}{2} \)

Q.6 Answer any two of the following:

a) What is the benefit that is represented by \( a_{x\overline{10}} - a_{x\overline{20}} \).

b) In a multipurpose policy of insurance there is a provision of payment of an annuity of 1.5% of sum assured for every month during the balance of selected period of 20 years, for a person aged 30 years at entry, in case of his death during the selected period of 20 years. Find the value of the benefit at 6% rate of interest if the sum assured under the policy is ₹10000/-. Given \( a_{10\overline{20}} = 11.311 \)

\( a_{30} = 11.4699 \)

\( \frac{D_{30}}{D_{50}} = 0.70212 \)

\( \frac{i}{1}^{(12)} = 1.027211 \)

c) Explain and derive the term \( t/\bar{a}_x = N_x + t \)

Dx

Q.7. A bond of ₹1000/- redeemable at par 10 years hence carries interest at the rate of 8% p.a. payable half yearly where the first interest payment is to be made after 6 months.

i) Find the price which a purchaser of the bond must offer if he wishes to realise 9% p.a. on his investment.

ii) If the holder of a single bond invests the sums of interest on the bond as they are received at rate of 9% p.a., find the total amount at the end of 10 years.

Given at 9% \( V^{10} = 0.4224 \)

\( \frac{i}{1}^{(6)} = 1.022, \ (1.09)^{10} = 2.3674 \)

Q.8. The annual premium for a whole life policy is 0.06 for five years and 0.03 there after or 0.07 for five years and 0.02 there after. Find the uniform annual whole life premium.

Q.9. a) How two or more mortality tables can be compared and what results can be drawn from such comparison?

b) Define \( m/q_x \) and derive

\( m/q_x = mp_x \times q_{x+m} \)

Q.10. a) Find at

i) 7% p.a. effective;

ii) 8% p.a. convertible half yearly, and

iii) 4½% convertible every 2 years the present value of ₹480/- p.a. payable quarterly for 12 years.

b) Derive \( p_x = \frac{1}{1+a_x} - d \)