FOUNDAION OF ACTUARIAL SCIENCE

Multiple Choice Questions, (All multiple choice questions carries two marks each)

Q.1. The present value of a series of 6 yearly payments, the first one being made at the end of 8 years is
   i) $7\overline{a}_6$  
   ii) $V^{7}a_{6\overline{7}}$  
   iii) $a_{\overline{13}} - a_{\overline{7}}$  
   iv) $V^{8}a_{6\overline{7}}$
   a) only iv is correct
   b) i, ii and iii are correct
   c) i and iii are correct
   d) all are incorrect

Q.2. Which of the following represent the present value of a perpetuity due of 1 p.a.
   a) $\ddot{a}$
   b) $\ddot{a}$
   c) $\ddot{a}$
   d) $\ddot{a}$

Q.3. The equation $\left[1 + \frac{i(m)}{m}\right]^{m} - 1$ gives value of:
   a) effective rate of interest p.a.
   b) nominal rate of interest p.a. convertible m times a year
   c) discount rate
   d) None of above.

Q.4. The present value of a deferred perpetuity annuity where first payment is made immediately on completion of m years is denoted by (give two correct options)
   a) $m|\ddot{a}$  
   b) $m|\ddot{a}$  
   c) $\frac{V^{m}}{i}$  
   d) $\frac{V^{m}}{d}$

Q.5. The rate of interest at which the sinking fund accumulates is called:
   a) Reproductive rate
   b) Remunerative rate
   c) Charging rate
   d) None of above

Q.6. $ax: \overline{n}$ - $ax: n-\overline{2}$ gives the benefit
   a) $Ax: \overline{n}$  
   b) $Ax: \overline{m}$  
   c) $Ax^{2}: \overline{n}$  
   d) None
Q.7. Solving for i in the equation of value
\[(1+i)^T = (1+i_1)^T_1 (1+i_2)^T_2 \cdots (1+i_n)^T_n \]
gives:
\[\text{a) Average interest yield} \]
\[\text{b) Money weighted rate of return} \]
\[\text{c) Time weighted rate of return} \]
\[\text{d) Linked internal rate of return} \]

Q.8. Which equation of value correctly represents the special Endowment Assurance providing both increasing death benefit and increasing survival benefit.
\[\text{a) } (IA)_{x:\overline{m}} = \frac{R_x - R_{x+n} - nM_{x+n}}{D_x} \]
\[\text{b) } (IA)_{x:\overline{m}} = \frac{R_x - R_{x+n} - nM_{x+n} + nD_{x-n}}{D_x} \]
\[\text{c) } (IA)_{x:\overline{m}} = \frac{R_x - R_{x+n} - nM_{x+n} + nD_{x-n}}{D_{x+n}} \]
\[\text{d) } (IA)_{x:\overline{m}} = \frac{R_x - R_{x+n} - nM_{x+n}}{D_{x+n}} \]

Q.9. These are ___ number of stages involved in the construction of a mortality table.
\[\text{a) eight} \]
\[\text{b) seven} \]
\[\text{c) five} \]
\[\text{d) four} \]

Q.10. Ax-Ax: \[\overline{\text{l}\text{l}}\text{ represent} \]
\[\text{a) } \text{Ax:} \overline{\text{l}} \]
\[\text{b) } \text{t/Ax} \]
\[\text{c) } \text{Ax:} \overline{\text{l}} \]
\[\text{d) None of above} \]

Q.11. If d is 11.47% find i = ?
\[\text{a) } 12.96\% \]
\[\text{b) } 13.25\% \]
\[\text{c) } 10.28\% \]
\[\text{d) } 12\% \]

Q.12. The present value of 1 payable at the end of n years is given by
\[i) \frac{1}{(1+i)^n} \quad ii) \frac{i}{(1+i)^n} \quad iii) V^n \quad iv) (1-d)^n \]
\[\text{a) Option i, iii and iv are correct} \]
\[\text{b) Option i, ii and iii are correct} \]
\[\text{c) Only option i is correct} \]
\[\text{d) Option i and iv are correct} \]

Q.13. Given that \(A_x = 0.3801\) and \(P_x = 0.0211\) find the value of \(\overline{a}_x\)
\[\text{a) 18.01} \quad \text{b) 17.01} \]
\[\text{c) 20.01} \quad \text{d) None of these} \]
Q.14. If $a_x = 9.381$, which of the following is the value of $a_x^{(12)}$
   a) 9.923  
   b) 7.397  
   c) 10.231  
   d) None of these

Q.15. Which of the following is not one of the stages involved in construction of mortality table.
   a) Determination of exposed to risk and enumeration of death  
   b) Obtaining observed rate of mortality  
   c) Graduation of observed death rate  
   d) Determination of cost of investigation

**Essay Type Questions (All essay type questions carries ten marks each)**

Q.16. i) A Purchaser of an irredeemable debenture gets a dividend of 3% every half year. What should be the purchase price in order to yield an effective rate of 8% p.a.?  
   ii) Corresponding to the interest rate of 21% per half year, find the nominal rate of discount per annum convertible quarterly.

Q.17. Mr. Rao wants to build a flat, for which he takes a loan ₹ 20,00,000 for 10 years. The effective rate of interest on his loan is 12% per annum, and the repayments towards the loan are to be made monthly in arrears.
   a) Find the monthly repayment Mr. Rao will have to make towards his loan?  
   b) Find the interest amount payable by Mr. Rao in the fifth year?  
   c) Find the capital amount repaid by Mr. Rao in the 20th installment?

Q.18. i) What is meant by policy value of a capital redemption policy?  
   ii) State the two methods of calculation of policy value.  
   iii) Derive expressions for both the methods and show that they are equal.

Q.19. The probability that a person aged 40 dies in five years is .04, that a person aged 45 dies in five years is .06 and that a person aged 50 dies in 5 years is .08. Find the probability that of the three persons aged 40, 45 and 50 respectively.
   a) Exactly one survives 5 years,  
   b) At least one survives 5 years,  
   c) At least one dies in 5 years,  
   d) The person aged 40 dies between ages 50 and 55.

Q.20. In a certain select mortality table and period during which selection is assumed to have effect on the mortality experienced is four years. Given the following table and that $l_{[20]} = 494985$, find the value of $l_{[20]+2}$, $l_{[24]}$

<table>
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<th>Age at Entry $[x]$</th>
<th>$d_{[x]}$</th>
<th>$d_{[x]+1}$</th>
<th>$d_{[x]+2}$</th>
<th>$d_{[x]+3}$</th>
<th>$d_{[x]+4}$</th>
<th>Age attained $x+4$</th>
</tr>
</thead>
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<tr>
<td>20</td>
<td>641</td>
<td>778</td>
<td>864</td>
<td>907</td>
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<td>963</td>
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Q.21. 
   i) Define temporary immediate life annuity. 
   ii) In a multipurpose policy of insurance there is a provision of payment of an 
   annuity of $1 \frac{1}{4} \%$ 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 this benefit 
   at 6% rate of interest if sum assured under the policy is ₹ 10,000/- and IALM 
   (94-96) modified ultimate mortality table is used.

Q.22. On the basis of the IALM (94-96) modified ultimate table at 6%, calculate the 
   net annual premiums for a sum assured of ₹ 10,000 for the following assurances 
   on (30) :
   i) Whole life assurance 
   ii) Whole life assurance, premiums limited to 20 years 
   iii) Endowment assurance for 25 years 
   iv) Endowment assurance for 25 years. Premiums limited to 15 years. 
   v) Deferred Temporary Assurance - the assurance to commence at age 35 and then 
   to continue for 10 years.

END