Fellowship

EXAMINATION QUESTION PAPERS MAY 2007

FL-81

FELLOWSHIP EXAMINATION

MATHEMATICAL BASIS OF LIFE ASSURANCE

Time: 3 Hours]   [Total Marks : 100

Answer any **FIVE** questions only.

All questions carry 20 marks each.

			Marks
1.	a)	Explain the terms Nominal and effective rate of interest with an example.	4
	b)	The amounts for a certain sum with compound interest at a certain rate in 5 years and 6 years are Rs. 9,367.60 and Rs. 9,929.60 respectively. Find the rate and the sum.	6

c) If $i^{(m)} = m\left((1+i)^{1/m} - 1\right)$ then prove that   4

$$i = \left(1 + \frac{i^{(m)}}{m}\right)^m - 1$$

d) Evaluate the following @ 6%   6

   i) $V^7 \, S_{\overline{11|}}$ ii) $(1+i)^4 \, a_{\overline{8|}}$ iii) $5/\ddot{a}_{\overline{11|}}$

Given : $S_{\overline{4|}} = 4.3746$ $a_{\overline{4|}} = 3.4651$

           $a_{\overline{7|}} = 5.5824$ $a_{\overline{15|}} = 9.7122$

2.   a)   Prove the relationship algebrically :   4

$$S_{\overline{n|}}^{(p)} = S_{\overline{n|}} \times \frac{i}{i^{(p)}}$$

b) By making uniform payments at the end of each year a Sinking Fund is set up to provide a Capital of Rs. 5,000 at the end of 15 years, money in the fund accumulates at 8% p.a. What is the position of the Fund at the end of 10 years ? What is the uniform payment required ?   6

Given : $S_{\overline{15|}} = 27.1521$ $S_{\overline{10|}} = 14.4866$ @ 8%

c) Find the probability that of two persons B and C aged 40 and 45   8
   respectively :
   i)   Both survive for 10 years
   ii) Both die within 10 years
   iii) One of them survives 10 years while the other dies within that
        period .
   iv) Atleast one of them survives 10 years.

Given :-

$$l_{40} = 963206, \qquad l_{45} = 946656,$$

$$l_{55} = 876889, \qquad l_{50} = 919712.$$

d) Define period of selection .   2

3. a) From the following data find the number living at age 34 .   4

Age X	No. of living	No. of dying	q_x
31	....	300	0.005
32	....	....	0.006
33	....	....	0.007
34	....	....	

b) If $L_x = L_{x+\frac{1}{2}}$ then prove that $q_x = \dfrac{2m_x}{2+m_x}$ 6

c) Explain in detail the life year method of investigation .   8

d) Which errors are usually noticed in census data ?   2

4. a) From the Table given below evaluate   8

$$^2P_{[30]} + 1 , \quad {}_{1}|_{2}\, q_{[31]} , \quad {}_{1}|\, q_{[30]} + 2 \quad \text{and} \quad {}_{1}|\, q_{[32]}$$

Age at entry (x)	$l_{[x]}$	$l_{[x]+1}$	$lx + 2$	Attained Ages x + 2
30	486024	485094	484096	32
31	485028	484080	483059	33
32	484012	483042	481994	34

b) A 15 year educational annuity policy is taken by a person aged 25 . The annuity at the end of 15 years is Rs. 1,000 per quarter for five years commencing six months after the expiry of 15 years. Find the present value of benefit at 8% p.a. interest.   6

Given : $V^{15} = 0.31524$ $V^5 = 0.68058$ $i^{(4)} = 0.0777$

c) From the commutation values given find out :   6

   i) The present value of an Increasing Temporary Assurance on the life of a person aged 25 at entry for term of 15 years where the Sum Assured keeps on increasing by Rs. 1,000 in every year .

   ii) The present value of an Increasing Whole Life Assurance on the life of a person aged 25 at entry where the sum assured keeps on increasing by Rs. 1,000 every year throught his life.

    Given : $R_{25} = 715813.78$ $R_{40} = 424773.69$

              $D_{25} = 229992.17$ $M_{40} = 17625.63$

    Assume first year Sum Assured is Rs. 1,000.

5. a) What does the following expression represent ?   6

   i) $a_x + \dfrac{m-1}{2m}$

   ii) $a_{x:\overline{n}|} + \dfrac{m-1}{2m}\left(1 + \dfrac{D_{x+n}}{Dx}\right)$

b) Using the values of commutation functions given find the values of :   10

   i) $\ddot{a}^{(4)}_{30:\overline{10}|}$ ii) $\ddot{a}_{30:\overline{10}|}$ iii) $_{10}|a_{30}$ iv) $5|\ddot{a}_{30:\overline{5}|}$

    Given : $N_{31} = 2496231$ $D_{40} = 93645$

             $N_{35} = 1906522$ $N_{41} = 1249369$

             $D_{30} = 170763$ $N_{40} = 1343014$

c) Mention the mathematical expression for net annual premium under following plans for Sum Assured of Re. 1 on the life of a child aged 2 at entry and the assurance vesting at age of 23 of the child .   4

   i) Children Deferred whole life Assurance

   ii) Children deferred Endowment Assurance Maturing at age 25 of the child .

6. a) On the basis of values given at 6% interest calculate the net annual **10**
premium under a children Deferred whole life plan for Rs. 20,000 on
the life of a child aged 3 years and the assurance vesting at age 18
years of child. Also calculate additional premium for the benefit of
waiver of premium payable during the deferrment period in the event
of death of the childs' father aged 40 years.

Given :-

$$\ddot{a}_{\overline{15}|} = 10.2950 \qquad V^{15} = 0.41727 \qquad \ddot{a}_{18} = 16.474$$

$$A_{18} = 0.06749 \qquad \ddot{a}_{40:\overline{15}|} = 10.029$$

b) Calculate for a life aged 30 : **10**

   i) The net annual premium under Endowment assurance for 25 years
   premium limited to 15 years.

   ii) The net annual premium limited to 15 years for a whole life
   Assurance for Rs. 5,000.

   iii) The net annual premium for a Double Endowment Assurance for
   15 years for basic sum assured of Rs. 5,000.

   iv) The net single premium for a 15 year temporary Assurance for
   Rs. 5,000.

   Given :-

X	Dx	Mx	Nx
30	170763	19801	2666994
45	68774	16285	927313
55	35573	12716	403807

7. a) A person aged 60 years desires to purchase an immediate annuity **6**
payable quarterly in arrear for 10 years certain and thereafter for life.
Calculate the quarterly instalment of the annuity that can be purchased
by a single premium of Rs. 19,085.75.

b) Explain various expenses that are taken into account while calculating **8**
premiums ?

c) Calculate office annual premium for an Endowment Assurance for 6
Rs. 50,000 to a person aged 30 years for 30 years. Make provision
for first year expenses at 40% of premium and 15‰ Sum Assured
and renewal expenses of 5% of premiums and 5‰ Sum Assured
basis .

Given :-

at 6% $ä_{30:\overline{30}|} = 14.160$ $A_{30:\overline{30}|} = 0.19852$

8. a) Briefly describe Net Premium Method of Valuation .   8

   b) Briefly describe Reversionary Bonus System and its advantages.   8

   c) What is the rationale for creating a Reserve for Revival of Lapsed 4
Policies ?

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