

**LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**



**B.Sc. DEGREE EXAMINATION – STATISTICS**

**FIFTH SEMESTER – NOVEMBER 2019**

**16/17UST5ES01/ST 5406 – ACTUARIAL STATISTICS**

Date: 06-11-2019

Dept. No.

Max. : 100 Marks

Time: 09:00-12:00

**Section A: Answer ALL the questions:**

**(10 X 2 = 20)**

- 1 Find the accumulated value of principal of Rs. 250 invested for 10 years at compound interest of 6% p.a.
- 2 Calculate the nominal rate p.a. corresponding to the effective rate 6% p.a. convertible quarterly.
- 3 Differentiate between uniform annuity and variable annuity.
- 4 What is deferment period?
- 5 Define discount.
- 6 What are the two types of stochastic interest rates?
- 7 Write the formula for the probability that a person aged  $x$  survives  $n$  years
- 8 What is a stationary population?
- 9 Give the expression for  $e_x$ .
- 10 Expand  $S_x$  in terms of  $D_x$

**Section B: Answer ANY FIVE questions:**

**(5 X 8 = 40)**

- 11 The amounts for a certain sum with compound interest at a certain rate in two years and in three years are Rs. 8820 and Rs. 9261 respectively. Find the rate and sum.
- 12 A sum of Rs.2000 is invested at a rate of interest of 5%p.a. After 7 years, the rate of interest was changed to 5% p.a. convertible half yearly. After a further period of 3 years, the rate was again changed to 6%p.a. convertible quarterly. What is the accumulated value at the end of 15 years from the commencement?
- 13 A fund is to be set up out of which a payment of Rs.100 will be made to each person who in any year qualifies for membership of a certain profession. Assuming that 10 persons will qualify at the end of one year from now, 15 at the end of 2 years, 20 at the end of 3 years, and so on till the number of qualifiers is 50 per annum. When it will remain constant, find at 5% p.a. effective what sum must be paid into the fund now so that it sufficient to meet the outgo
- 14 Derive the expression to find the present value and accumulated value of Increasing annuity where in the successive Instalment form a geometric progression.
- 15 A has taken a loan of Rs2000 at rate of interest 4% pa payable half yearly. He repaid Rs. 400 after 2 years, Rs.600 after a further 2 years and cleared all outstanding dues at the end of 7 years from the commencement of the transaction. What is the final payment made by him?
- 16 Find the probability that of 2 persons A and B aged 30 and 35 respectively
  - i.) both die before 55.
  - ii.) both die after 60.
  - iii.) A dies before 65 while B dies after 60.
  - iv.) Atleast one of them survives to 70.
- 17 Define the following:
  - (i) Annuity
  - (ii) Immediate annuity
  - (iii) Annuity due

(iv) Deferment period

- 18 What is the object of constructing a mortality table? Give the general procedure and stages involved in the construction of mortality table.

Section C: Answer **ANY TWO** questions:

(2 X 20 = 40)

- 19 a) A deposit annually Rs. 200 p.a. for 10 years, the first deposit being made one year from now; and after 10 years the annual deposit is enhanced to Rs. 300 p.a. Immediately after depositing the 15 payment he closes his account. What is the amount payable to him if interest is allowed at (i) 6% p.a. (ii) 9% p.a.?  
10
- 19 b) In lieu of a single payment of Rs. 1000, at the present moment a person agrees to receive 3 equal payments at the end of 3 years, 6 years and 10 years respectively. Assuming a rate of interest of 6% p.a. what should be the value of each of the 3 payments?  
10
- 20 a) Prove that  $(1+i)^t a_n = v^{n-1} S_n = S_t + a_{n-t}$ .  
10
- 20 b) Calculate the present value of a deferred annuity payable for 10 years certain, the first payment falling due at the end of 6 years from the present time. The annuity is payable at the rate of Rs. 100 p.a. for the first 5 years and Rs.200 p.a. thereafter.  
10
- 21 Explain  $S_n$  (accumulation of a single investment) and  $A_n$  (accumulation of a series of annual investments) in the context of stochastic interest rates and derive mean and variance of  $S_n$  and  $A_n$ .  
20
- 22 a) Complete the following life table.  
10

Age	$l_x$	$d_x$	$q_x$	$L_x$
10	1000000	-	.00409	-
11	-	-	.00370	-
12	-	-	.00347	-
13	-	-	.00342	-

- 22 b) A person aged 30 years approached a life office for special type of policy providing for the following benefits. 10
- i.) Rs.1000 on death during the first 5 years.  
ii.) Rs.2000 on death during the next 15 years.  
iii.) survival benefit of Rs.500 at the end of the 5<sup>th</sup> year .  
iv.) Further payment of Rs.2000 on survival of 20 years.
- Find the annual premium assuming that the premium paying term is 20 years.

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