

# LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034



## B.Sc. DEGREE EXAMINATION – STATISTICS

FOURTH SEMESTER – APRIL 2023

### UST 4601 – ACTUARIAL STATISTICS

Date: 06-05-2023

Dept. No.

Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

#### PART A

Answer **ALL** the questions:

(10 x 2 = 20)

- 1 The amount with compound interest of a certain principal at 6%p.a. is Rs.2809. Find that principal when the period is 2 years.
- 2 Find the rate of interest corresponding to a rate of discount of 0.10.
- 3 Find the present value at rate of interest of 6% p.a. of Rs. 300 payable 5 years hence.
- 4 A sum of money is invested at 4% p.a. effective. How long will it take to double itself?
- 5 Give the formula for present value of increasing perpetuity.
- 6 What is a varying interest rate model?
- 7 What is the use of mortality table?
- 8 What is  $l_x$  and  $d_x$  in the mortality table?
- 9 Write the formula for the probability that a person aged  $x$  survives  $n$  years.
- 10 How do you define Central Death Rate?

#### PART B

Answer **ANY FIVE** questions:

(5 x 8 = 40)

- 11 Find the accumulated value of Rs. 1000 at the end of 10 years:  
(i) at nominal rate of interest of 12 % p.a. convertible quarterly  
(ii) at effective rate of interest of 3 % per half year.
- 12 A series of 8 annual sums of money is payable, the first payment taking place at the end of one year from now. The first five payments are Rs 300 each and the last three payments are Rs. 200 each. Find the present value of eight payments @ 8% p.a.
- 13 Derive the expressions for present value and accumulated value of immediate increasing annuity.
- 14 Derive the expression to convert effective rate of discount to nominal rate of discount and Vice – Versa.
- 15 A man wishes that Rs. 2,50,000/- be paid to his daughter after 10 years. A bank agrees to pay this for a lump sum invested now. If the rate of interest is 10% p.a. for first 3 years, 7.5% p.a. for second 3 years and 6.26% p.a. for the last 4 years, find the lump sum to be invested by the man.
- 16 Raju has taken loan of Rs. 2000 at rate of interest 4% p.a. payable half yearly. He repaid Rs400 after 2 years, Rs.600 after a further period of 2 years and cleared all outstanding dues at the end of 7 years from the commencement of transaction. What is the final payment made by him?
- 17 Explain in detail the probabilities of survival and death.
- 18 Using the LIC ( 1970 – 73 ) Ultimate table find the following probabilities
  - (i) that a life aged 30 dies within the next 10 years
  - (ii) that a life aged 30 dies after 10 years
  - (iii) that a life aged 30 survive 10 years

PART C

Answer ANY TWO questions:

(2 x 20 = 40)

- 19 a) Explain in detail the classification of annuities. (10)  
 b) A particular finance company 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 person will qualify at the end of one year from now, 15 at the end 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 that it may be sufficient to meet the outgo. (10)

- 20 a) Fill up the blanks in the following portion of a life table: (10)

Age X	$l_x$	$d_x$	$q_x$	$p_x$
10	1000000		0.00409	
11			0.00370	
12				0.99653
13				0.99658
14			0.00342	

- b) A loan of Rs. 3000 is to be repaid with interest at 6% p.a. by means of an immediate annuity for 10 years. Find the level payment. What will be the interest and principal contained in the 5<sup>th</sup> instalment? What will be the principle outstanding immediately after the 8<sup>th</sup> payment is made? (10)
- 21 A company consider that on average it will earn interest on it funds at the rate of 4% p.a. However, the investment policy is such that in any one year the yield on the company's funds is equally likely to take any value between 2% and 6%. (20)  
 (i) Find the mean accumulation and variance of accumulation of single premium of Rs.1 with terms of 5, 10, 15, 20 and 25 year  
 (ii) Find the mean accumulation of annual premium of Rs.1 with terms of 5, 10, 15, 20 and 25 year.

- 22 a) Calculate the mean and variance of the accumulated value of an initial investment of Rs.40,000 at the end of 25 years if the annual rates of return are assumed to conform to the varying interest rate model and follow a *Gamma* (16,200) distribution. (10)

- b) What are the common ways by which a loan can be repaid? Discuss all the methods by giving suitable examples. (10)

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