



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

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

**FIFTH SEMESTER – APRIL 2018**

**ST 5406/ST 5404 - ACTUARIAL STATISTICS**

Date: 10-05-2018  
Time: 09:00-12:00

Dept. No.

Max. : 100 Marks

**Section A**

**Answer ALL questions. (10X2 = 20)**

1. Define interest.
2. Define discounted value.
3. What is an annuity?
4. What do you mean by perpetuity?
5. Define deferred annuity.
6. Define stochastic interest rates.
7. What is the use of mortality table?
8. What is life assurance?
9. What is expectation of life?
10. What is meant by premium?

**Section B**

**Answer any FIVE questions.**

**(5X8 = 40)**

11. Differentiate between accumulated value and present value and derive their expressions when a single payment is made for a period of  $n$  years.
12. Derive the expressions for effective rate of interest corresponding to nominal rate of interest and vice-versa.
13. In lieu of a single payment of Rs. 100000 at the present moment a person agrees to receive three 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 three payments?
14. Explain deferred annuities and derive expressions for present value and accumulated value of deferred annuities.
15. A company considers that on average it will earn interest on its funds at the rate of 4% pa. 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%. For a single premium accumulation with term of 10 years at an investment of Rs. 1000, find the mean accumulation and the standard deviation of the accumulation at the maturity date. (Ignore expenses.)
16. Explain in detail the various columns of a mortality table and the probabilities of survival and death.

17. Fill up the blanks in the following portion of a life table:

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	

18. An employee of an institution has to retire at age 55. A gratuity benefit of one month's salary for each year of service subject to a maximum benefit of 15 months' salary is payable to an employee on retirement or death. Find the probability that

- (i) Full gratuity benefit will be payable to a person aged 30, who has just now completed 5 years of service.
- (ii) The gratuity benefit payable will not exceed 10 months' salary
- (iii) The gratuity benefit payable will be atleast 12 months' salary
- (iv) The employee earns atleast 12 months' salary as a gratuity benefit payable at death.

### Section C

Answer any TWO questions. (2X20 = 40)

19. (a) Explain in detail the classification of annuities.

(b) Derive expressions for Present Value and Accumulated Value of immediate annuity.

(12 8)

20. A loan of Rs. 10,000/- is to be repaid with interest at 8% p.a. by means of an immediate annuity for 5 years. Find the level payment. Prepare a table showing the loan schedule. What will be the principal and interest contained in each of the 5 installments?

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  $A_n$ .

22. (a) Explain the principal of life assurance and elaborate on life assurance premiums.

(b) Explain temporary assurance and endowment assurance and derive the expressions for their present values in terms of their commutation functions. (8 + 12)

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