



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

**M.Sc.DEGREE EXAMINATION – STATISTICS**

SECOND SEMESTER – APRIL 2018

**17/16PST2ES01- ACTUARIAL STATISTICS**

Date: 25-04-2018  
Time: 01:00-04:00

Dept. No.

Max. : 100 Marks

**Section – A**

**Answer all the questions**

**(10 x 2 =20)**

1. Find the accumulated value of the principal of Rs. 20000 invested for 25 years at compound interest 8% p.a.
2. Calculate the nominal rate p.a. corresponding to the effective rate 6% p.a. convertible quarterly.
3. A sum of money is invested at 6% p.a. effective. How long will it take to double itself?
4. Find the present value of Rs. 3000 due 15 years at a rate of discount 8% p.a.
5. Write the formula for present value of deferred annuity due.
6. Find the present value of an increasing annuity for 25 years under which the successive payments are 9, 18, 27, ..., p.a. Assume rate of interest 7% p.a.
7. Define the probabilities  ${}_{12}q_{32}$  and  ${}_{10}q_{45}$  and express them in terms of the  $l_x$  functions
8. Give the formula for expectation of life.
9. Write the present value of life annuities for single person aged  $x$ .
10. Define double endowment assurance.

**Section –B**

**Answer any five questions**

**(5 x 8 = 40)**

11. Derive an expression to find the present value and accumulated value of annuity.
12. a) The amounts for a certain sum with compound interest at a certain rate in ten years and in twelve years are Rs.25600 and Rs. 30400 respectively. Find the rate and the sum.  
b) What is the present value of Rs.4567 due at the end of 25 years, the rate interest being 6% p.a. for first 10 years from now and 7% p.a. convertible half yearly for the next 15 years.

13. Raja has invested Rs.34000 at rate of interest 8 %p.a. After 15 years the rate of interest is changed 9% p.a. convertible half yearly. After a further period of 5 years the rate was again changed to 7 % p.a. convertible quarterly. What is the accumulated value at the end of 25 years from commencement?
14. A person has purchased a bond of the face value of Rs. 1000 on which interest is payable yearly at 5% p.a. He received in all 4 interest payments, the first one falling due one year after purchase. At the end of 4 years the bond has matured for payment at par. If the person has realized an interest yield of 6 % p.a. in the transaction, what is the final purchase price?
15. A series of 10 annual sums of money is payable. A first payment taking place of the end of 1 year from now. The first 6 payments are Rs. 600 each and the last 4 payments are Rs. 400 each. Find the present value of the 10 payments at 6 % p.a.
16. Find the probabilities that
- a life aged 33 will die between the ages 40 and 45
  - a life aged 33 will not die between 40 and 45
  - a life aged 33 will die in the 10<sup>th</sup> year from now
  - a life aged 33 will not die in the 10<sup>th</sup> year from now.
17. Write down the expression for the probability in the under mentioned cases
- Of the two lives aged 25 and 30 , at least one life dies before attaining age 70
  - Of three lives aged 40,40 and 45, exactly two lives survives 10 years
  - Life aged 28 survives 12 years and dies in the 13<sup>th</sup> or 14<sup>th</sup> year.
18. Derive an expression for present value of Deferred Temporary Assurance and pure endowment assurance in terms of commutation functions.

### Section – C

**Answer any two questions**

**( 2x 20 = 40)**

19. a) Derive the relationship between  $a_n$  and  $s_n$  and also verify algebraically.
- b) A fund is to be set up out of which a payment of Rs. 500 will be made to each person who in any year qualifies for membership of a certain profession. Assuming that five persons will qualify at the end of one year from now, 10 at the end of 2 years, 15 at the end of 3 years, and so on till the number of qualifiers is 50 p.a, when it will remain constant, find at 6% per annum effective what sum must be paid into the fund now so that it may be sufficient to meet the outgo.
- (10 +10)
20. a) Under a settlement of property Mr. Raj is entitled to receive Rs. 2400 p.a. adinfinitum, the first payment being due at the end of 12 years. Find the present value of Mr.Raj's right @ 8% p.a.
- b) Suppose that a loan of Rs 15000 is taken at the rate of interest of 8% p.a. and repayable in 5 years. What are the most three common ways the loan amount can be repaid?

( 6 + 14 )

21. Describe the methods of construction of Mortality table.

22. a) The following particulars are given

$x$	31	32	33	34	35	36
$l_x$	95333	95088	95334	95046	95335	95029
$d_x$	245	268	288	295	306	330

Calculate the value of the following three benefits and allowing rate of interest of 6% p.a.

- i. The value of Temporary Assurance of Rs. 3000 for 3 years for person aged 31
- ii. The value of Endowment Assurance benefits of Rs.3000 for 4 years to a person aged 31.
- iii. The value of a Pure Endowment of Rs.800 for a person aged 31 receivable on attaining age 33.

b) Derive an expression for  $a_{x:n}$  and  $\ddot{a}_{x:n}$  ( 10 +10 )

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