

QP CODE: 25050520



Reg No :

Name :

MSc DEGREE (CSS) EXAMINATION, DECEMBER 2025

First Semester

M Sc ACTUARIAL SCIENCE

Core Courses - AS010102 - FINANCIAL MATHEMATICS 1

2019 Admission Onwards

1EEE0F1F

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

Weight 1 each.

1. What you meant by cashflows?
2. An investor deposits £5,000 into a savings account that pays 10% compound interest at the end of each year. Compare how much the investor would have after 6 years if the money were:
 - (i) invested for 6 years
 - (ii) invested for 3 years, then immediately reinvested for a further 3 years.
3. An investment of £1,000 accumulates to £2,500 after 5 years.
 - (i) Calculate the accumulation factor $A(0,5)$.
 - (ii) (a) Calculate the simple annual interest rate that would give the accumulation factor in part (i).
4. Give the relation between i and $i^{(12)}$
5. $i=11\%$, calculate d , $i^{(6)}$ and $d^{(12)}$
6. Give d in terms of i
7. Derive an expression for annuity due.
8. What is deferred annuity ?
9. What is equation of value ?
10. A loan of £900 is repayable by level monthly payments for 3 years, with interest payable at 18.5% pa effective. Calculate the amount of each monthly payment.

(8×1=8 weightage)





Part B (Short Essay/Problems)

Answer any **six** questions.

Weight 2 each.

11. Types of insurance contracts
12. (i) Calculate the effective annual rate of interest corresponding to:
 - (a) a nominal rate of interest of 11% pa convertible half-yearly
 - (b) a nominal rate of interest of 12% pa convertible monthly.
 (ii) Calculate the rate of interest convertible monthly corresponding to:
 - (a) an effective rate of interest of 14.2% pa
 - (b) a nominal rate of interest of 11% pa convertible three times a year.

13. The force of interest is given by

$$\delta(t) = \begin{cases} 0.08 & 0 \leq t < 5 \\ 0.13 - 0.01t & 5 \leq t \end{cases}$$

calculate the accumulated value at time 10 of an investment of 500 at time 2.

14. A company expects to receive a continuous cashflow of £350 pa for the next five years. It also expects to have to pay out £600 at the end of the first year and £400 at the end of the third year. Calculate the net present value of these cashflows if $v(t) = 1 - 0.01t$ for $0 \leq t \leq 5$.
15. The force of interest at time t is given by

$$\delta(t) = 0.01 + .05t \quad 0 \leq t \leq 10$$
 Calculate the accumulated value at time 10 of a continuous payment stream that is received from time 4 to time 8, under which the rate of payment at time t is $0.3 + 1.5t$.
16. An alien on the planet Xi is currently aged exactly 48 years old. When the alien retires at exact age 60, it will receive an income of 500 per year, payable continuously. Given that all aliens on the planet Xi die at exact age 76, calculate the present value of the retirement benefits using an interest rate of 10% pa effective.
17. An annuity is payable annually in advance for a term of 20 years. The payment is £500 in year 1, £550 in year 2, and so on, increasing by £50 each year. Calculate the present value of this annuity, assuming that the effective rate of interest is 5% pa for the first twelve years and 7% pa thereafter.
18. Calculate D , given that $P = 127.12$, $R = 125$, $i = .75\%$ and $n = 10$.

(6×2=12 weightage)

Part C (Essay Type Questions)

Answer any **two** questions.

Weight 5 each.

19. A 182-day treasury bill, redeemable at \$100, was purchased for \$96.50 at the time of issue and later sold to another investor for \$98 who held the bill to maturity. The rate of return received by the initial purchaser was 4% per annum effective.
 - (i) Calculate the length of time in days for which the initial purchaser held the bill.



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- (ii) Calculate the annual simple rate of return achieved by the second investor.
(iii) Calculate the annual effective rate of return achieved by the second investor.

20. The force of interest at time t is:

$$\delta(t) = \begin{cases} 0.08 & 0 \leq t < 5 \\ 0.13 - 0.01t & 5 \leq t \end{cases}$$

Determine expressions for the accumulation factor from time 0 to time t .

21. Payments of £1,000 pa are payable quarterly in arrears from 1/1/20 to 31/12/25.
The annual effective rate of interest is 3.4% for calendar years 2020-2023 (inclusive) and 4.2% thereafter. Calculate:
- (i) the present value of the payments at 1/1/20
 - (ii) the accumulated value of the payments at 1/1/27.
22. An investor in property expects to receive rental payments for the next 50 years in line with the following assumptions:
- 1) The current level of rental payments is £20,000 per annum, paid quarterly in advance.
 - 2) Payments will remain fixed for 5-year periods. At the end of each 5-year period the payments will rise in line with total inflationary growth over the previous five years.
 - 3) Inflation is assumed to be constant at 3% per annum.
 - 4) The interest rate is 12% per annum effective.
- Calculate the present value of the rental income the investor expects to receive.

(2×5=10 weightage)