KISII UNIVERSITY

UNIVERSITY EXAMINATIONS

FIRST YEAR EXAMINATION FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE IN ACTUARIAL SCIENCE
SECOND SEMESTER 2022/2023
[JANUARY-APRIL, 2023]

BACS 110: FUNDAMENTALS OF ACTUARIAL SCIENCE

STREAM: Y1S2 **TIME: 2 HOURS**

DAY: THURSDAY, 12:00 – 2:00 PM **DATE: 30/03/2023**

INSTRUCTIONS

1. **Do not write anything on this question paper.**
2. ***Answer question ONE and any other TWO questions.***
3. ***Tables for actuarial examinations and approved electronic calculators may be used.***

QUESTION ONE (30 Marks). (Compulsory)

a) Distinguish between simple interest and compound interest. Use a graph to illustrate your answer. (4marks)

b) (i) What is the effective rate of per half year is equivalent to 1.3% per month effective. (3marks)

iii) Determine the effective rate per 1.7 years is equivalent to 1.3% per month effective? (3 marks)

c) A deposit of $200 is invested at time 8 years. Using a force of interest of δ_t= 0.1- 0.02t, find the present value of this payment at the end of 3 years. (5 marks)

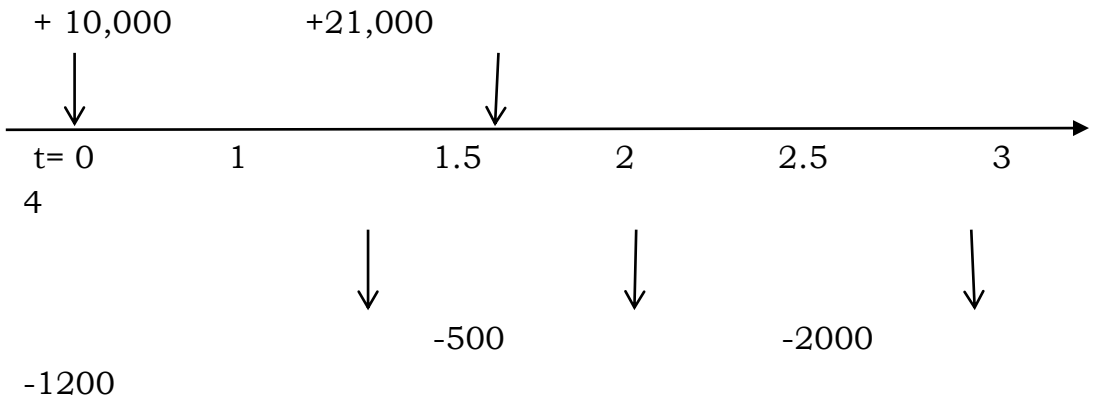
d) A 10 year bond, which has been issued, provides semi- annual coupons of 6% a year in arrears. It is redeemed at per. What price is paid (per Shs 100 nominal value) if the bond yields an annual effective rate of interest of 8%. (6 marks)

e) A deposit of kshs 8900is invested at time zero. The annual effective interest rate is 5% from time 7 years and thereafter is 6%. Calculate the accumulated value of investment at time 10 years. (4 marks)

f) Explain the difference between amortization and sinking fund loan repayment methods. Identify the method commonly used by banks for loan repayments. (5 marks)

QUESTION TWO (20 Marks)

Mr. Omolo is banking with Kenya commercial bank and an extract of his cash flow is shown in the time line below (the time axis is calibrated in years). The effective rate of interest is 0.08.



i) What is the accumulation at time t = 5 of this cash flow? (8 marks)

i) What is the present value at time t = 0 years of this cash flow? (5 marks)

ii) What is the value at time t = 2 of this cash flow? (7 marks)

QUESTION THREE (20 marks)

a) (i)Distinguish between annuity due and a perpetuity (4 marks)

(ii) State two financial derivative securities in the financial market. (2 marks)

b) The force of interest δ_t is;

$$\delta_t = \begin{cases} 0.04 & 0 < t \leq 5 \\ 0.01\,(t^2 - t) & t > 5 \end{cases}$$

Calculate the accumulated value of Ksh 10,000 payable at time 10. (4 marks)

c) Kerima buys an annuity- immediate from an insurance company. He pays Kshs 300,000 and in return receives level payments of Kshs X at the end of each year for the next 15 15 years. The annual effective interest rate is 6%. Calculate X.

(5 marks)

d) A loan of Kshs 1, 500,000 is repaid using the amortization method by monthly payments at the end of each month for 8 years. The nominal rate of interest convertible quarterly is 8% a year.
Find;

(i) The monthly payment. (2 marks)

(ii) The principal outstanding at the end of the 4^{th} year after the payment has been made. (3 marks)

QUESTION FOUR (20 marks)

Mr. Bosire takes out a loan of Kshs 700,000 to be repayable by level annual instalments over 20 years, where the repayments are calculated at effective rate of 7% p.a.

a) How much is each annual instalment? (3 marks)

b) What is the new repayment amount if he asks the lender for the term to be extended by 5 years, immediately after he has made the 13^{th} repayment? (5 marks)

c) If instead of extending the term, he had asked to miss the 14^{th} and 15^{th} repayments. What will each of the remaining instalments be?

(6 marks)

d) What will the new repayment amount if he had decided to repay 50,000 at time 13 together with his 13^{th} repayment. (6 marks)