

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

**EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN
ACTUARIAL SCIENCE**

ACMT 102: FUNDAMENTAL OF ACTUARIAL MATHS 1

STREAMS:

TIME: 2 HOURS

DAY/DATE: WEDNESDAY 18/12/2024

11.30 A.M – 1.30 P.M

INSTRUCTIONS:**Question One (30 marks)**

- A. Explain the factors that influence the interest rates. **(4 marks)**
- B. Differentiate between an annuity certain and a contingent annuity. **(4 marks)**
- C. Autoloan requires payments of kshs 30,000 per month for 3 years at a nominal annual rate of 9% Compounded monthly. What is the present value and its accumulated value? **(4 marks)**
- D. Suppose that $A(T) = \alpha t^2 + 10\beta$. If x invested at time 0 accumulates to ksh 500 at time 4 and ksh 1,000 at time 10, find the amount of the original investment. , x **(5 marks)**
- E. It is known that ksh 600 invested for two years will earn ksh 264 in interest. Find the accumulated value of ksh 2,000 invested at the same rate of annual compound interest for three year. **(5 marks)**
- F. Define effective rates and elaborate two types of effective rates. **(4 marks)**
- G. Find the effective annual interest rate that is equivalent to a simple interest rate of 3% p.a over 4 years. **(4 marks)**

Question two (20 marks)

- A. Find the accumulated value of kshs 30,000 to be paid at the end of 8 years with a rate of compound interest of 5%
- i) Per annum **(2marks)**

- ii) Convertible quarter **(2 marks)**
- iii) Convertible Monthly **(2 marks)**
- B. Differentiate between effective rates and nominal rates. **(4 marks)**
- C. What are the two factors considered when deciding whether to use real or money interest rates? **(4 marks)**
- D. Kshs 200,000 is deposited at the beginning of each year for 15 years starting at the beginning of the 25th year, the account makes equal annual payments forever. If the account earns 6% effective per year, what is the amount of these annual payments? **(4 marks)**

Question three (20 marks)

- A. The following payments are to be received: kshs 500 at the end of the first year, kshs 520 at the end of the second year, kshs 540, at the end of third year and so on, until the final payment of kshs 800 using the annual effective interest rate of 2%.
- i) Determine the present value of those payments at $t=0$ **(3marks)**
- ii) Determine the accumulated value of these payments at the time of the last payment. **(3 marks)**
- B. The force of interest takes the following values
- $$\delta(t) = 0,04 \quad 0 \leq t \leq 10$$
- $$\delta(t) = 0.01(t-10)^2 + 0.04 \quad 10 < t$$
- Calculate the accumulation of ksh 150 from $t=0$ to $t=20$ **(4 marks)**
- C. Define the term annuity and give and explain four types of annuities. **(10 marks)**

Question four (20 marks)

- A. Calculate the present value as at 01/03/2005 of a series of payments of kshs 1000 payable on the 1st day each month from April 2005 to December 2005 inclusive, assuming a rate of interest of 6% p.a convertible monthly. **(5 marks)**
- B. i) Find the annual effective interest rate i which is equivalent to the rate of compound interest of 8% convertible quarterly. **(3marks)**
- ii) Find the compound interest $i^{(2)}$ which is equivalent to an annual effective interest rate of 8% **(3 marks)**

- iii) Find the compound interest $i^{(4)}$ which is equivalent to the rate of compound interest payable semi-annually. **(3 marks)**
- C. Investor A deposits kshs 1000 into an account paying 4% compounded quarterly. At the end 3 years, he deposits an additional kshs 1000. Investor B deposits X into account with force of interest $\delta_t = \frac{1}{6} + t$.
After five years, investors A and B have same amount of money. Find X. **(6 marks)**

Question Five (20 marks)

- A. What is a perpetuity immediate **(2 marks)**
- B. Kshs 4,600 is invested at time zero and proceeds at time 10 are kshs 8200. Calculate $A(7,10)$ if $A(0,9)=1.8$, $A(2,4)=1.1$, $A(2,7)=1.32$, $A(4,9)=1.45$ **(12 marks)**
- C. i) Kshs 500 is invested in an account which pays nominal interest of 8% p.a convertible half yearly. Find the amount in the account after 3 years. **(3 marks).**
ii) A payment of kshs 800 is due in 5 years' time. Calculate the present value of this payment at an interest rate of 9% p.a convertible monthly. **(3 marks)**
- D. Define force of interest. **(2 marks)**
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