CHUKA   **UNIVERSITY**

UNIVERSITY EXAMINATIONS

FIRST YEAR EXAMINATION FOR THE AWARD OF BACHELOR DEGREE IN

ACMT 102: FUNDAMENTAL OF ACTUARIAL MATHEMATICS

STREAMS: BCOM Y1S1

TIME: 2 HOURS

DAY/DATE: MONDAY 14/12/2020   **8.30 A.M -10.30 A.M.**

INSTRUCTIONS:

Question one (30 marks) compulsory

A. Define the term annuity and explain three types of annuities   (6 marks)

B. Calculate the present value as at 1st March 2020 of series payments of Kshs. 6,200 payable on the first day of each month from April 2020 to December 2020. Inclusive, assuming a rate of interest of 6% p.a convertible monthly   (6 marks).

C. Define a nominal interest and deduce the equation to covert the nominal rate into effective rate of interest   (4 marks)

D. (i)Kshs 1,800 is invested in an account which pays nominal interest of 8% p.a convertible half yearly. Find the amount in account after 3 years.   (4 marks)

(ii) A payment of Kshs 3,200 is due in 5 years time. Calculate the present value of this payment at an interest rate of 9% p.a convertible monthly. (4 marks)

E. Distinguish between the effective rate of interest and effective rate of discount. Give the relationship between discount and accumulation factors. (6 marks)

Question two (20 marks)

A. Explain the principle of consistency (3 marks)

B. Kshs 9,500 in invested at time 0 and the proceeds at time 10 are 16,500. 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

Represent using a diagram (11 marks)

C. An investor's Bank balance at various times as follows

1 Jan 2020	1July 2020	1Jan 2021
8,579	9,031	9,655

    i. Calculate the effective Six Monthly rate between 1Jan 2020 to 1st July 2020

(3 marks)

    ii. Effective annual rate between 1 Jan 2020 to 1 Jan 2021 (3 marks)

Question Three

A. Find the present value as at 1 June 2019 of payments of Kshs 2,000 payable on the 1st day of each Month from July 2019 to December 2019 inclusive, assuming a rate of interest of 8% p.a convertible quarterly. (6 marks)

B. An investment of Kshs 3,950 is in an account that accumulated to Kshs 7,320 after 5 years.

i. State the accumulation factor A(0,5) (3 marks)

ii. a. Find the simple interest rate which would give the accumulation factor in part (1)

(3 marks)

b. Find the annual compound interest rate which could give the accumulation factor.

(3marks)

C. Define annuities paid in arrear (2 marks)

i. Deduce a formula to find the present value of annuities paid in arrear. Explain the functions (3 marks)

Question Four

A. Ksh1,299 is invested at a discount rate of 18% p.a convertible monthly for the first 3 months followed by an interest rate of 20% p.a convertible quarterly for the next 9 months. Calculate the accumulated value of the end of year (5 marks)

B. What is the definition of force of interest rates and effective interest rates.

(2 marks)

i. What is the relationship between force of interest rates (3 marks)

C. The force of interest is given by

$$f(t) = \begin{cases} 0.04 + 0.002t & 0 \leq t \leq 10 \\ 0.015T - 0.08 & 0 \leq t \leq 12 \\ 0.07 & 12 \leq t \end{cases}$$

Find the expression for the present value at time o of Unit 1 due to time t (10 marks)

Question 5 (20 marks)

A. Express a monthly effective rate of interest of 20% as a nominal annual interest rate converted monthly   (3 marks)

B. i. What is the corresponding two monthly effective interest rate for a nominal interest rate of 3% p.a convertible two monthly.   (3 marks)

ii. Hence calculate the equivalent annual effective interest rate   (3 marks)

C.Kshs 8,578 has been invested in an account which pays a force of interest of 8% p.a. find the amount after 3 years.   (5 marks)

D.Define;

   a. Interest   (2 marks)

   b. Capital   (2 marks)

   c. Accumulated value   (2marks)

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