CHUKA UNIVERSITY

UNIVERSITY EXAMINATIONS

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

ACMT 202: FUNDAMENTAL OF ACTUARIAL MATHEMATICS II

STREAMS: **TIME: 2 HOURS**

DAY/DATE: TUESDAY 18/4/2023 **2.30 P.M. – 4.30 P.M.**

Question One (30 Marks)

a) Define a contingent payment model (2 marks)

b) Consider a policy which consists of a payment of Kshs. 50,000 contingents upon retirement in 15 years. Suppose that the probability of a 45 years old to retire in 15 is 0.82 i.e. is ${}_{15}P_{45}$ = 0.82. Find the actuarial present value of the contingent payment. Assume, a 6% interest compounded annually. (5marks)

c) A whole life insurance is used to (20) is payable at the moment of death. You are given (1) the time at death random variable is exponential with δ= 0.02 (ii) δ = 0.14.
Calculate (i) $\bar{A}_{20}$ (ii) ${}^{2}\bar{A}_{20}$ and Var ($\bar{Z}_x$) (8marks)

d) Define an n-year term life insurance. Deduce its present random variable, its actuarial present value and its variance. (8 marks)

e) The age of death random variable is exponential with parameter 0.5. A life aged 35 buys 25year life insurance policy that pays I upon death. Assume an annual effect interest rate of 7%.
Find the actuarial present value of this policy (5 marks)

f) What is an endowment policy? Give two types of endowment policies. (2 marks)

Question Two (20 marks)

a) Define a term life insurance and state its,

i). Present value random variable.

ii). The actuarial present value.

iii). Its second moments

iv). Its variance (10 marks)

b) Let the remaining lifetime at birth random variable X be uniform on (0,100). Let ${}_{101}Z_{30}$ be a contingent payment random variable for a life aged x=30.

Find i). ${}_{101}A_{30}$

ii). ${}_{101}{}^{2}A_{30}$

Var $({}_{10/}Z_{30})$ if $\delta = 0.05$ (10 marks)

Question 3 (20 marks)

a) Explain what recursion relations for life insurance are. Give two types of recursion relations (4 marks)

b) Show that $A^{1}_{x:\overline{n|}} = vq_x + vP_xA_{x+1}{}^{1}_{:\overline{n-1|}}$ (5marks)

c) Define an annually increasing whole life insurance (2 marks)

d) Give that K(x) is uniform on (0,3). Calculate $(I\bar{A}_x)$ if force of interest ? = 0.05 (5 marks)

e) Show that $\bar{A}^{1}_{x}:\overline{n|} = 1/\delta\ A^{1}_{x}:\text{n}+\overline{|}A^{1}_{X} + n\urcorner$ (4marks)

Question 4 (20 marks)

a) Explain what is meant by contingent annuities and give three types of contingent annuities

(8 marks)

b) For a disability insurance claim

i). The claimant will receive payment at the rate of Kshs. 20,000 per year, payable continuously as along as she remains disabled.

ii). The length of payment period in years will be a random variable with pdf $f(t) = te^{-t}$

iii). Payment begin immediately.

iv). δ= 0.05. Calculate the actuarial present value of the disability payments at the time of disability (6 marks)

c) Explain a continuously n-year temporary life annuity. Find it's the present value random variable and its actuarial present value (6 marks)

Question 5 (20 marks)

A. What is continuous n-year certain and life annuity. State is present value random variable (4 marks)

B. You are given the following probability mass function of k(x)

K	0	1	2
Pr (kx) = k	0.2	0.3	0.5

Find

$$\ddot{a}_x \text{ and } {}^2\ddot{a}_x = E\left(\ddot{Y}_X^2\right) \text{if @ } i=0.05$$

(8 marks)

C. Deduce the actuarial present value of whole life discrete annuity immediate. (4 marks)