CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

CHUKA & THARAKA

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

ACMT 102: FUNDAMENTALS OF ACTURIAL MATHEMATICS

STREAMS: BSC (ANSC/HORT) **TIME: 2 HOURS**

DAY/DATE: MONDAY 09/12/2019 **2.30 P.M. – 4.30 P.M.**

INSTRUCTIONS: Answer question ONE and any other TWO questions

QUESTION ONE (30 MARKS)

(a) A bond offers an annual coupon rate of 6% with interest paid annually. The bond matures in four years and has market discount rate of 4%. What is the price of the bond per 100 of par value [4 marks]

(b) Consider a debt of kshs 100,000 that is to be amortized over 7 years at 7% interest. Calculate the value of annual payment that will achieve this [3 marks]

(c) Calculate the effective annual rate of interest corresponding to

(i) Anominal rate of 11% p.a convertible half yearly [1 mark]

(ii) Anominal rate of interest of 12% p.a convertible monthly [1 mark]

(d) Consider a university student who has won a prize that offers a lump sum of kshs 1,000,000 to invest now or ksh 550,000 to invest at the end of this year and another ksh 550,000 to invest at the end of the following year. If all investments are assumed to learn and interest of 10% p.a. which should she choose if she intend to withdraw the money after 4 years. [5 marks]

(e) Let X denote the present value of an annuity consisting of payment of ksh 10,000 payable at the end of each of the next 8 years, valued using an interest rate of 8% p.a convertible quarterly and let Y denote the present value of an annuity consisting of payment of kshs 20,000 payable at the end of every year for the next 4 years, valued using interest rate of 8% p.a convertible half yearly. Calculate the ratio X/Y [5 marks]

(f) Using the AM92 life tables find the value of

(i) $\ddot{a}_{[30]} : 30]$ of 4% interest p.a

(ii) $\dot{a}_{[40]} : 30]$ at 6% interest p.a [2 marks]

(g) Calculate the following probabilities on the basis of ELT 15 (males) life tables

(i) The probability that a life aged 30 survive for atleast 10 years

(ii) The probability that a life aged 50 years dies within 10 years

(iii) The probability that a life aged 60 dies between age 80 and 85

(iv) The probability that a life aged 60 dies within the first five years after retiring at age 65 [4 marks]

(h) State two main types of benefits payable under simple life insurance contract [2 marks]

(i) A rate of interest 4% p.a. convertible monthly is equivalent to what annual effective rate of discount [3 marks]

QUESTION TWO (20 MARKS)

Consider an immediate annuity payable annually in arrears such that payment are ksh 20,000 p..a for the first 5 years and ksh 8,000 p.a for the next 5 years together with a lump sum of ksh 50,000 at the end of the 10 years

(i) Calculate the combined present value of the immediate annuity [10 marks]

(ii) Calculate the amount of the level annuity payable continuously for 10 years having the same present value as the payments a (i) assume an effective interest rate of 10% p.a. [10 marks]

QUESTION THREE (20 MARKS)

Compute the accumulated value after 6 months of an investment of ksh 200,000 at time O at the following rate of interest

(i) An effective rate of interest of 5% p.a [5 marks]

(ii) A force of interest of 0.05 p.a [5 marks]

(iii) A rate of interest of 5% p.a convertible monthly [5 marks]

(iv) A rate of interest of 10% p.a convertible quarterly [5 marks]

QUESTION FOUR (20 MARKS)

Consider a 4 year bond that offers 9% coupon rate with interest paid annually. What is the price of the bond assuming the following sequence of spot rates per 100 of par value [20 marks]

Time to maturity	Spot rate
1 year	6.25%
2 years	7.50%
3 years	8.55%
4 years	9.30%

QUESTION FIVE (20 MARKS)

(a) Calculate the present value as at 1 June 2018 of 41 monthly payment each of ksh 5,000 commencing on 1 January 2019, assuming rate of interest of 10% p.a. convertible half yearly. [10 marks]

(b) Mr. Timau interest ksh 300,000 for 13 months at i=0.09, then switch to an investment that pays interest at a force of $\delta = 0.11329$ for two years. How much has Timau investment accumulated to [10 marks]
