



MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS

2023/2024 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER

SCHOOL OF BUSINESS AND ECONOMICS

BACHELOR OF SCIENCE IN FINANCIAL ECONOMICS

COURSE CODE: ECF 4104-1

COURSE TITLE: FINANCIAL MATHEMATICS

DATE: DECEMBER 2023

TIME

INSTRUCTIONS TO CANDIDATES

Answer Question **ONE** and any other **TWO** questions

SECTION A (20 MARKS)

1. (a) Explain three determinants of the levels of interest [6 marks]
- (b) Differentiate between nominal rate of interest and force of interest [1 marks]
- (c) Mike receives cash flows of 100 today, 200 in one year and 100 in 2 years. The present value of this cash flow is 346.46 at an annual effective rate of interest i . Calculate i . [5 marks]
- (d) The force of interest $\delta(t)$ is a function of time and is given by;
- $$\delta(t) = \begin{cases} 0.04 + 0.02t^2 & , 0 \leq t < 5 \\ 0.05 & , 5 \leq t \end{cases}$$
- Calculate the present value of a continuous payment stream received at a rate of $10e^{0.01t}$ unit per annum between time $t=6$ and $t=10$. [4 marks]
- (e) Consider two investment schemes A and B. Scheme A offers 12% with annual compounding. Scheme B offers 11.5% with monthly compounding. Calculate the effective rates of interest for the two schemes. For the investment schemes calculate the accumulated amount after 10 years on a principal of \$1000 [4 marks]

SECTION B (15 MARKS EACH)

2. (a) The price of a zero coupon bond with a face value of \$1000 is \$599.4584. The yield rate convertible semi-annually is 6.5%. Calculate the maturity date. [5 marks]
- (b) An investor purchased a bond with exactly 20 years to redemption. The bond, redeemable at par, has a gross redemption yield of 5.5% per annum effective. It pays coupons of 4% per annum, quarterly in arrear. The investor pays tax at 25% on the coupons only.
- i Calculate the price paid for the bond. [4 marks]
- After exactly eight years, immediately after the payment of the coupon then due, this investor sells the bond to another investor who pays income tax at a rate of 25% and capital gains tax at a rate of 35%. The bond is purchased by the second investor to provide a net return of 6.5% per annum effective.
- ii Calculate the price paid by the second investor. [6 marks]
3. (a) A bank lends a company 6500 at a fixed rate of interest of 10% p.a. The loan is to be repayed by 5 level annual payments. Calculate the interest and capital repayment at each repayment date. [9 marks]
- (b) Assuming an interest rate of 12% convertible monthly,
- (i) Calculate the combined present value of an immediate annuity payable monthly in arrears such that the payments are shs.100,000 p.a for the first six years and shs.40,000 p.a for the next four years, together with a lumpsum of shs.200,000 at the end of the 10 years. [3 marks]
- (ii) Calculate the amount of the level annuity payable continuously for 10 years having the same present value as the payments in (i) above. [3 marks]

4. (a) The force of interest $\delta(t)$ is a function of time t and is given by the formula;

$$\delta(t) = \begin{cases} 0.03 + 0.001t^2 & , 0 \leq t < 7 \\ 0.01t & , 7 \leq t < 10 \\ 0.1 & , 10 \leq t \end{cases}$$

- (i) An investment of 1 is made at time $t=4$. Find the value to which it will have accumulated by time $t=6.5$ [5 marks]
- (ii) Find the present value at time $t=0$ of an investment of 15 due at time $t=20$ [4 marks]
- (iii) Find the constant force of interest which would lead to the same present value in (ii) being obtained [3 marks]
- (iv) What is the effective rate of interest from time $t=8$ to time $t=9$ [3 marks]

THE END