JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF MATHEMATICS AND ACTUARIAL SCIENCE

UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF   SCIENCE ACTUARIAL

1st   YEAR 1ST SEMESTER 2021/2022

REGULAR (MAIN)

COURSE CODE: WAB 2101

COURSE TITLE: PRINCIPLE OF ACTUARIAL SCIENCE

EXAM VENUE: STREAM: (BSc Actuarial Science)

DATE: 19/12/2022   EXAM SESSION: 15.00-17.00PM

TIME: 2.00 HOURS

Instructions:

1. **Answer question 1 (Compulsory) and ANY other 2 questions**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

Qusetion one

1.a) State and Explain the principles of Actuarial science   (7 Marks)

b) Define the following terms as used in insurance   (5 Marks)

        i)   Insurer
        ii) Insured
        iii) Sum assured
        iv) Premium
        v) Surrender Value

c)Suppose an amount *C* is deposited in an account that pays simple interest at the rate of *ix100%* per annum. Then after *n* years the deposit will haveaccumulated to? Give the expression
                    (2 Marks)

d)Discount Ksh 10,000 for 3 years using a simple discount rate of 5% *pa*.   (2 Marks)

e) An investor must make a payment of Ksh. 5,000 in 5 years' time. The investor wishes to make provision for this payment by investing a single sum now in a deposit account that pays 10% per annum compound interest. How much should the initial investment be? (3 Marks)

f)What is an annuity?   (1 Mark)

g)State whether each of the following annuities is paid in arrear or in advance, immediate or deferred, level, simple increasing or simple decreasing.   (5 Marks)
    (i)   Payments of Ksh.200 paid at the start and halfway through each of the next five years.

    (ii)   A payment of Ksh.500 in five years, Ksh. 1000 in ten years, Ksh. 4000 in forty years.

h) Define Internal rate of return.

                    (2 Marks)

i) Explain why banks and other organisations lending money to people buying homes with mortgages often impose restrictions and/or penalties if all or part of the mortgage is repaid during the first 3 years.

                    (3 Marks)

Question two.

a) An investor puts Kshs. 5,000 in a savings account that pays 10% simple interest at the end ofeach year. Compare how much the investor would have after 6 years if the money was:

      (i)   invested for 6 years

      (ii)   invested for 3 years, then immediately reinvested for a further 3 years.

                                            (7 Marks)

b) An investor's bank balance at various times was as follows:

                  1 Jan 2012 1 Jul 2012 1 Jan 2013
                   Kshs.3,000Kshs. 3,100 Kshs. 3,300

   Calculate the:

      (i)   effective six-monthly rate between 1 Jan 2012 and 1 Jul 2012

      (ii)   effective annual rate between 1 Jan 2012 and 1 Jan 2013.

                                              (7 Marks)

c) Show that the effective rate of interest, when accumulating using a constant simple interest rate, decreases over time.   (6 Marks)

Question Three

a) Find the effective annual interest rate that is equivalent to a simple interest rate of 3% *pa* over 4 years.   (3 marks)

b) A bank account pays 10% effective annual interest rate over 5 years. Find the equivalent:

(i)   simple annual interest rate

(ii)   effective monthly interest rate

(iii)   effective biennial interest rate

(iv)   effective annual **discount** rate

(v)   simple annual **discount** rate.

                                            (10 marks)

c) An investor is to pay £800 for a property. The investor will then be entitled to receive rent payments for 99 years payable at the end of each year at a constant rate for the first

33 years, increasing to double that rate for the next 33 years and three times that rate for the remaining 33 years. The value of the property at the end of the 99 years is expected to be £250,000. Find the amount of the rent payable in the first year, if the investor expects to obtain a rate of return of 8% on the purchase.   (7 marks)

Question four

a) A woman has invested some money in a company run by some ex-criminals. In return for the investment she expects to receive £100 at the end of each of the next ten years. Interest rates are 5% *pa* effective.
Calculate the present value of her investment by:
   (i)   ignoring the possibility that the payments might not be made.

   (ii) assuming the probability of receiving the first payment is 0.95, the second payment is 0.9, the third payment is 0.85

   (ii)   increasing the force of interest by 0.04652.(10 Marks)

b) Give two examples to illustrate the problems of using accumulated profit to assess the suitability of an investment project.   (4 Marks)

d) Find the accumulated profit after 20 years of a project that pays out $20,000 at time 0 and then receives $5,000 at times 5 to 15, inclusive. Assume an annual effective rate of interest of 3%.   (6 Marks)

Question Five [20 marks]
a.   For each of the projects outlined below, calculate:

(i)   the internal rate of return.

(ii)   the range of interest rates at which money can be borrowed in order for the projects to be viable.

(iii)   the accumulated profit at the end of 5 years, assuming that the projects are financed by a loan subject to interest at 6.25%.

Project C
Initial outlay Kshs.100,000 Proceeds (at the end of 5 years) Kshs.140,000

Project D
Initial outlay Kshs.100,000 Proceeds (at the end of each of the next 3 years) Kshs.38,850
                    (10 marks)

b.Indicate other considerations that might be taken into account when deciding between Project *C* and Project *D*.   (10 marks)