



**KISII UNIVERSITY**  
**UNIVERSITY EXAMINATIONS**  
**SPECIAL EXAMINATION**  
**FIRST YEAR EXAMINATION FOR THE AWARD OF**  
**DEGREE IN BACHELOR OF ACTUARIAL SCIENCE**  
**FIRST SEMESTER 2021/2022**  
**(JULY, 2022)**

**BACS 100: INTRODUCTION TO ACTUARIAL SCIENCE**

**STREAM: Y1 S1**

**TIME: 2 HOURS**

**DAY: TUESDAY 3.00 PM – 5.00 PM**

**DATE: 26/07/2022**

**INSTRUCTIONS:**

- 1. Do not write anything on this question paper.**
- 2. Answer Question ONE (Compulsory) and any other TWO Questions.**

**QUESTION ONE (30 MARKS)**

- (a) Define the word actuarial science and actuary (2marks)
- (b) The force of interest,  $\delta(t)$ , is a function of time and at any time  $t$ , measured in years, is  $a + bt$  where  $a$  and  $b$  are constants. An amount of £45 invested at time  $t = 0$  accumulates to £55 at time  $t = 5$  and £120 at time  $t = 10$ .
- i. Calculate the values of  $a$  and  $b$ . (5marks)
  - ii. Calculate the constant force of interest per annum that would give rise to the same accumulation from time  $t = 0$  to time  $t = 10$ . (5marks)
- (c) Describe the actuarial control cycle (5marks)
- (d) The force of interest  $\delta(t)$  is a function of time and at any time  $t$ , measured in years, is given by the formula

$$\delta(t) = \begin{cases} 0.04 + 0.02t & 0 \leq t < 5 \\ 0.05 & 5 \leq t \end{cases}$$

- i. Derive and simplify as far as possible expressions for  $v(t)$ , where  $v(t)$  is the present value of a unit sum of money due at time  $t$ . (6marks)
- ii. Calculate the present value of £1000 due at the end of 17 years. (4marks)
- (e) Name and explain different types that actuaries can give to their stakeholders(3marks)

### QUESTION TWO (20 MARKS)

- (a) The force of interest,  $\delta(t)$ , is a function of time and at any time  $t$ , measured in years, is given by the formula

$$\delta(t) = \begin{cases} 0.05 + 0.001t & 0 \leq t \leq 20 \\ 0.05 & t > 20 \end{cases}$$

- i. Derive and simplify as far as possible expressions for  $v(t)$ , where  $v(t)$  is the present value of a unit sum of money due at time  $t$ . (6marks)
  - ii. Calculate the present value of £100 due at the end of 25 years. (4marks)
  - iii. Calculate the rate of discount per annum implied by the transaction in part (ii) (5marks)
- (b) Use each of the above mitigation strategies to suggest how each of the following risks can be mitigated:
- the risk of poor investment performance to a life insurance company
  - The risk of terrorist attacks on airplanes to an individual. (5marks)

### QUESTION THREE (20 MARKS)

- (a) Explain different types of investors depending on their preference to risk (3marks)
- (b) Name and explain two types of risk(2marks)
- (c) Define institutional investors and give roles played by investment banks (5marks)
- (d) A loan of £16,000 is repayable by ten equal annual payments. The annual effective rate of interest is 4%. Calculate using loan schedule :
  - i. the interest element of the 4th payment (4marks)
  - ii. the capital element of the 7th payment and 10<sup>th</sup> (6marks)

### QUESTION FOUR (20 MARKS)

- (a) Name and describe two risks affecting asset proceeds (2marks)
- (b) Name and describe three risks affecting liability outgoes (3marks)
- (c) Describe five types of cash flow scenarios (5marks)
- (d) An investment of £1,000 made at time 0 is accumulated at the following rates: 8% per annum simple for two years, followed by a rate of discount of 6% per annum for two years. Calculate the accumulated amount of the investment after 4 years. (6marks)
- (e) A loan of £3,000 is repayable in 91 days at a simple discount rate of 4% per annum. Calculate the amount repayable in 91 days' time. (4marks)

**QUESTION FIVE(20 MARKS)**

- (a) Define a real rate of interest and money rate of interest. (1marks)
- (b) Explain different types of life insurance and different types of general insurance contracts (3marks)
- (c) Define the word underwriting and give key features in general and life insurance contacts. (3marks)
- (d) Calculate  ${}_{10/5}q_{60}$  (3marks)
- (e) The force of interest,  $\delta(t)$ , at time  $t$  is given by:

$$\delta(t) = \begin{cases} 0.04 + 0.003t^2 & 0 < t \leq 5 \\ 0.01 + 0.03t & \text{for } 5 < t \leq 8 \\ 0.02 & t > 8 \end{cases}$$

Calculate the present value (at time  $t=0$ ) of an investment of £1,000 due at time  $t=10$ . (6marks)

- (f) Define  ${}_{12}p_{43}$  (2marks)
- (g) Outline the codes that govern the professional conduct standards of an actuary (2marks)