



**KISII UNIVERSITY**

**UNIVERSITY EXAMINATIONS**

**SPECIAL EXAMINATION**

**FOURTH YEAR EXAMINATION FOR THE AWARD OF DEGREE OF**

**BACHELOR OF SCIENCE ACTUARIAL SCIENCE**

**SECOND SEMESTER 2021/2022**

**(JULY, 2022)**

**BACS 401: ACTUARIAL THEORY OF PENSION FUND**

**STREAM: Y4 S2**

**TIME: 2 HOURS**

**DAY: MONDAY, 3.00 PM – 5.00 PM**

**DATE: 25/07/2022**

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**INSTRUCTIONS:**

- 1. Do not write anything on this question paper.**
- 2. Answer Question ONE (Compulsory) and any other TWO Questions**
- 3. Tables for actuarial examinations and approved electronic calculators may be used.**

**QUESTION ONE (30 Marks). (Compulsory)**

- a) i) Explain the difference between final salary schemes and defined contribution schemes (6 marks)
- ii) Distinguish between contributory and non- contributory Occupational pension schemes. (4 marks)
- iii) State three factors final salary scheme depends on. (3marks)

- b) On 1 January 1980 Sam joins an occupational pension scheme at exact age 30. Sam's initial salary rate is Kshs 20,000p.a. Sam is promoted on 1<sup>st</sup> January 1990 and 1<sup>st</sup> July 2007 with a new salary of Kshs 30,000 and Kshs 40,000 respectively. At age 60 Sam retires and receives a pension of  $1/60^{\text{th}}$  of his pensionable salary for every year of service.

Calculate Sam's pension if pensionable salary is defined in each of the following ways;

- i) Final salary rate. ( 3 marks)
  - ii) Average of salaries earned in the 5 years before retirement. ( 4 marks)
  - iii) Average of the salaries earned throughout the period of service. ( 4 marks)
- c) Explain **four** reasons why many employers establish a staff retirement benefit schemes for their employees. ( 6 marks)

### QUESTION TWO (20 Marks)

- a) A Small company pension scheme provides a pension of  $1/60^{\text{th}}$  of final pensionable salary for each year of service, commencing on retirement between age 60 and 65 . There are no other benefits.

Final pensionable salary is defined as the average salary received in the three years immediately before retirement.

The scheme has 50 members who are each 40 years old, have 10 years' past service and have current salary rate of kshs 35,000.

You are given that the basis for valuing the pension scheme is the same as in the pension fund section of the formulae and tables for actuarial Examinations (2002)

You may assume that salaries increase continuously throughout the year.

- a) Calculate the expected present value of the past service liability for these members. (5 marks)
- b) The Company has decided to revise the scheme so that future service benefit will be based on career average salary, there will be no changes made to the past service benefits.
  - i) Allowing for the changes in benefits design; calculate the expected present value of the future service liability of these members. (5 marks)
  - ii) Give reasons why the company may wish to make this change to the scheme's benefits. ( 2 marks)
  - iii) For a member who intends to retire at age 65, calculate the expected loss in annual pension resulting from this change to the benefit design. You are given that  $\sum_{x=40}^{64} = 237.566$  (3 marks)
  - iv) Given that the scheme holds assets of Kshs 1,800,000, calculate the contribution rate (as percentage of salaries) required to finance the scheme benefits in full by the member's retire.

( 5 marks)

**QUESTION THREE (20 marks)**

- a) A pension scheme has 1000 members each aged 50 exactly. Over the last year each member earned \$ 17,000. You expect future experience to follow that given in the pension fund section of the formulae and tables for actuarial Examinations (2002).Salaries increase continuously through time.

Calculate;

- (i) The number of deaths from the scheme over the next year. ( 4 marks)
- (ii) The expected number of ill-health retirement from the scheme over the next 3 years. ( 4 marks)
- (iii) The expected salary rate of the surviving members at exact 51. ( 4 marks)
- b) Explain the importance of pension schemes. ( 8 Marks)

**QUESTION FOUR (20 marks)**

A pension fund provides an age retirement pension of  $1/60^{\text{th}}$  of final pensionable salary for each year of service. Final pensionable salary is defined as the average of the salaries earned in the last three years before retirement.

- a) Calculate the expected present value of ;
- i) the past service age retirement pension, and ( 4 marks)
- ii) the future service age retirement pension ( 4 marks)
- for a member aged 40 with exactly 10 years' past service, given that the member's current salary rate is Kshs 30,000 p.a., that salaries are revised continuously and the basis to be used is that given in the pension fund section of the formulae and tables for actuarial Examinations (2002).
- b) Scheme members make contributions to the pension scheme of 5% of their salary. The contributions are returned accumulated with interest of 2% p.a on either death or withdrawal.
- The member described in (a) above has earned Kshs 250,000 during his career so far accumulated with 2% p.a interest.
- Calculate the expected values of;
- i) The past service return of contributions, and ( 6 marks)
- ii) The future service return of contributions. ( 6 marks)