CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF BACHELOR OF SCIENCE IN ACTUARIAL SCIENCE

ACMT 403: ACTUARIAL THEORY OF PENSION FUNDS

STREAMS: BSc. **TIME: 2 HOURS**

DAY/DATE: TUESDAY 09/04/2024 **8.30 A.M. – 10.30 A.M.**

QUESTION ONE

a) Calculate the probability that an active scheme member, who is currently aged exactly 39, will retire in normal health over the year of age ending on his 62nd birthday. Use the service table defined in the Pension Scheme Tables in the Examination Tables booklet for your calculation. (3 marks)

b) Calculate the expected present value of a disability benefit of £5,000 pa payable weekly to a healthy life now aged 45. Assume that interest, mortality, sickness rates and recovery rates are consistent with those given in the Tables. (3 marks)

c) Write down an expression, using commutation functions, for the EPV of a lump sum of £150,000 paid immediately on the event of ill-health retirement, for an active pension scheme member aged exactly 48. Assume that ill-health retirement is only permitted before the member reaches his 60th birthday. Define all the symbols that you use. (4 marks)

d) State the objectives of an employer in providing medical benefits as part of the employee benefit package. (6 marks)

e) List any three economic and three demographic assumptions needed for the valuation of a defined benefit pension scheme. (6 marks)

f) A man, who is currently aged 45 and has a salary of $10,000, is entitled to a benefit from a scheme at age 65. The present value of this benefit is $60,000. He joined the scheme 10 years ago and the benefit accrues uniformly. Using the Attained Age method, calculate the level percentage of salary that must be paid until age 65 in order to fund for this benefit. Assume that his salary will increase at the rate of 4% pa and that the return on the fund will be 6% pa. Ignore all pre-retirement decrements. (8 marks)

Question Two

a) List the advantages of a defined benefit pension scheme from the point of view of the employee. (4 marks)

b) Briefly explain what actuarial gains or losses are. When do we incur an actuarial loss and when do have a gain. (4 marks)

c) You are valuing a pension plan effective January 1, 2004.Normal retirement benefit is $600 per month. The valuation method used is Individual Level Premium. The valuation date is December 3 1 ,2004. The valuation rate is 6%. There are no preretirement deaths or withdrawals. All retirements occur at age 65. You are given that $\ddot{a}_{65}^{12} = \frac{25}{3}$.

There is only one participant who was born January 1, 1970. What is the normal cost for 2004 as on December 31,2004? (4 marks)

d) Discuss what is NSSF. What is its key mandate and what have been the recent reforms when it comes to pension contributions? (8 marks)

Question Three

a) Explain what pensionable salary is, in three different ways (3 marks)

b) Explain what is meant by diversification and why it is an important principle for pension scheme investment. (4 marks)

c) List Options that may be granted in relation to retirement benefits. (6 marks)

d) On retirement due to any reason (ie normally or through ill-health) before age 65, a pension scheme provides a pension of £20,000 pa paid from the date of retirement for the remainder of life. However, should the member retire the 65th birthday, this annual pension is increased to £25,000 pa, also payable for life. Calculate the EPV of this

benefit, for an active member currently aged exactly 57, using the assumptions of the Pension Scheme Tables and 4% pa interest. (7 marks)

Question Four

a) State the advantages and disadvantages of offering a lump sum on retirement. (6 marks)

b) Elizabeth has been a member of a pension scheme since starting work at the age of 25. She is currently aged 40. The scheme gives a pension on retirement equal to n/60ths of final pensionable salary, where n is the years of service to retirement (including fractions) and final pensionable salary is the average of the prior three years' earnings.

Calculate the value of her past and future service pension liabilities in the pension scheme, assuming that scheme experience follows that of the Pension Scheme Tables, if her earnings in the previous year totaled $45,000. Assume interest of 4%. (7 marks)

c) Calculate the annual contribution, as a percentage of salary, which should be made by the company in respect of Elizabeth over her remaining term to retirement. Assume that she will contribute 4% of salary pa and that the scheme has already built up $37,000 in respect of her pension. (6 marks)

Question Five

a) Outline the factors a member should take into account when deciding whether to take an enhanced transfer value. (6 marks)

b) Define the term Net Replacement Ratio. (2 marks)

c) ln a developed country, no income tax is levied on the first $15,000 per annum of an individual's income, which includes income from pensions. A 30% rate of income tax is levied on income in excess of $15,000 per annum. There is no income tax relief given for pension contributions or repayments on house loans.

Adam is currently working and earns a pre-tax income of $60,000 per annum. He pays pension contributions of 10% of pre-tax earnings and repayments on house loans of $1 ,000 per month, both of which will cease on retirement. Calculate the Net Replacement Ratio if Adam's pre-tax pension in retirement is $30,000 per annum. (5 marks)

d) You are calculating the expected present value (EPV) of group insurance benefits for Gary, age 35, an active employee of BMK. You are given:

i. The benefit for death of an active employee is 100, 000. The benefit for disability of an active employee is 50, 000. There are no other benefits.
ii. Benefits are payable as a lump sum at the end of the year of the event.
iii. Decrements follow the below Service Table, with d, w, and i representing death, withdrawal, and disability, respectively.
iv. i = 0.08

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