JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF MATHEMATICS AND ACTURIAL SCIENCE

UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE ACTURIAL

3RD YEAR 1ST SEMESTER 2016/2017 ACADEMIC YEAR

MAIN REGULAR

COURSE CODE: SAC 305

COURSE TITLE: PENSION MATHEMATICS

EXAM VENUE: **STREAM: (BSc. Actuarial)**

DATE: **EXAM SESSION:**

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.**

QUESTION 1 [COMPULSORY] [30 Marks]

(a) Describe three methods of benefit arrangement that can be availed to members of a pension scheme. [**6 Marks**]

(b) An employer wishes to introduce a lump-sum retirement benefit payable immediately on retirement at 65 or earlier other than on the grounds of ill-health. The amount of the benefit is Kshs10,000 for each year of an employee s service, with proportionate parts of a year counting.

(i) Give a formula to value this benefit for an employee currently aged x with n years of past service, defining all terms used. [**6 Marks**]

(ii) Using the Pension Scheme Tables from the Actuarial Formulae and Tables, calculate the value for an employee currently aged 30 exact with exactly 10 years past service. [**4 Marks**]

(c)A company is about to establish a pension scheme that will provide an age retirement benefit of $\frac{n}{60}$ths of final pensionable salary where n is total number of years of service. Final pensionable salary is the average salary in the three years before retirement.An employee who will become a member of the pension scheme is currently aged 55 exact has and will be granted exactly 20 years of past service. The employees salary in the year before the valuation date was Kshs.40,000.

(i) Calculate the present value of benefits for this member (including future service). [**4 Marks**]

(ii) Calculate the contribution required to fund this benefit as a percent-

age of future salaries. [**4 Marks**]

(d)Define the following pension benefit valuation models

(i) Emerging Cashflow Model [**2 Marks**]

(ii) Benefit Event Model [**2 Marks**]

(iii) Commutation Functions Model [**2 Marks**]

QUESTION 2[20 MARKS]

Using the following assumptions and data $i = 10\%$, $e = 8\%$, $A = 60$, $R = 65$ and $a_R^{'} = 12$, calculate the AL and SCR under the Attained Age method for the following pension scheme with members details as tabulated below.

Age	Past Service(Years)	Salary
20	2	20,000
30	10	15,000
50	30	30,000
60	40	50,000

The same earnings definition is used for benefit purposes. You may assume, for simplicity, that contributions are paid continuously and salary growth is continuous.

[**20 Marks**]

QUESTION 3[20 MARKS]

(a) State any four options that can be availed to members of a pension scheme. [**8 Marks**]

(b) A new defined benefit scheme is being set up. The employer is considering providing the following options for the members:

- Payment of a retirement benefit at a date earlier than normal retirement age.
- Payment of a retirement benefit at a date earlier than normal retirement age.
- Payment of a transfer value if a member leaves employment before normal retirement age.

Payment of a transfer value if a member leaves employment before normal retirement age. Allowing conversion of pension to cash at retirement.

(i) Set out the general issues to be considered before a decision is made to offer any of the above options. [**8 Marks**]

(ii) State a simple equation of value for the early retirement option. [**4 Marks**]

QUESTION 4[20 MARKS]

(a)A pension scheme provides a pension of $\frac{1}{60}$ of Final Pensionable Salary for each year of scheme service upon retirement for any reason. Fractional years of service count proportionately. Final Pensionable Salary is defined as the average annual salary in the three years immediately prior to retirement. Members are required to contribute continuously at the rate of 5% of salary.

You are given the following data in respect of Member A as at 1 January 2003:

Age: 50 exact

Annual rate of salary: Kshs.50,000

Using the data in the Actuarial Tables, calculate, in respect of Member A:

(i) The expected present value of future contributions payable. [**5 Marks**]

(ii) The expected present value of the pension benefits on retirement for any reason based on future service. [**6 Marks**]

(b)Three member of a pension scheme whose age nearest birthday is 45 have the following annual rates of salary and exact number of years of past service

- A:15,000 20 years
- A:15,000 20 years
- A:15,000 20 years

For the three members find the present value of a pension payable on age-retirement, $\frac{1}{100}$ths of the average salary in the final 3 years of before retirement for each year of service, include fractions. Give separately the values of past service and future service benefits. **[6 Marks]**

QUESTION 5[20 MARKS]

(a) Describe what is meant by is a notional portfolio of assets. **[7 Marks]**

(b) Consider a government fixed interest investment. Show that, for this investment,

$$\text{Discounted Value} = MV_{FI} \times (gry \times a_{n\neg} + v^n)@i\%$$

Where gry- gross redemption yield for the index n-the term of the index

[8 Marks]

(c) A United Kingdom pension fund has 3 pounds of its equity assets invested in various trusts. A broad discounted income model is used to value the assets and is assumed that the FTSE Actuaries Share Indices Investment Trusts. The dividends yield on this index at the valuation date is 3.40%. If the valuation rate of interest is 9% p.a and the assured rate of dividend, g, is 5% p.a . Find the discounted value of these assets at valuation date. **[5 Marks]**