**JAROMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**BSc.ACTUARIAL SCIENCE**

**3RD YEARS FIRST SEMESTER**

**COURSE NAME: METHODS OF ACTUARIAL INVESTIGATION I**

**COURSE CODE: SAC 301**

**INSTRUCTIONS: ATTEMPT QUESTION ONE AND ANY OTHER TWO**

**QUESTION 1: COMPULSORY**

**QUESTION ONE.**

a) State the features of a Eurobond. [4 marks]

b) An investor purchases a Eurobond on the date of issue at a price of £97 per £100 nominal. Coupons are paid annually in arrear. The bond will be redeemed at par twenty years from the issue date. The rate of return from the bond is 5% per annum effective.

i. (1) Calculate the annual rate of coupon paid by the bond. [5 marks]
ii. (2) Calculate the duration of the bond [5 marks]

c)An ordinary share pays annual dividends. A dividend of 25p per share has just been paid. Dividends are expected to grow by 2% next year and by 4% the following year.
Thereafter, dividends are expected to grow at 6% per annum compound in perpetuity.
(i) State the main characteristics of ordinary shares. [5 marks]
(ii) Calculate the present value of the dividend stream described above at a rate of interest of 9% per annum effective from a holding of 100 ordinary shares. [6 marks]
(iii) An investor buys 100 shares in (ii) for £8.20 each. He holds them for two years and receives the dividends payable. He then sells them for £9 immediately after the second dividend is paid.
Calculate the investor s real rate of return if the inflation index increases by
3% during the first year and by 3.5% during the second year assuming dividends grow as expected. [5 marks]

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**QUESTION TWO**

a)State and explain the three conditions for Redington's immunization [3 marks]
b)Write short notes on the terms Duration and Immunization [6 marks]
c)A fund must make a payment of kshs.50,000 at the end of the sixth and eighth year.Show that if interest rates are currently 9% of all duration to small changes in interest rates can be achieved by holding an appropriate chosen combination of a 5 year zero coupon bond and a 10 year zero coupon bond [11 marks]

**QUESTION THREE**

(a) Distinguish between the following fixed interest security terminologies

(i) Gross redemption yield, Net redemption yield and Running yield

(ii) Zero coupon Bond and indexed linked Bond

(iii) Strip, redeemable and irredeemable Bond [7 marks]

(b) An investor purchased a bond with exactly 15 years to redemption. The bond, redeemable at par, has a gross redemption yield of 5% per annum effective. It pays coupons of 4% per annum, half yearly in arrear. The investor pays tax at 25% on the coupons only.

(i) Calculate the price paid for the bond**.** [3 marks]

(ii) After exactly eight years, immediately after the payment of the coupon then due, this investor sells the bond to another investor who pays income tax at a rate of 25% and capital gains tax at a rate of 40%. The bond is purchased by the second investor to provide a net return of 6% per annum effective.

Required

Calculate the price paid by the second investor also determine , to one decimal place, the annual effective rate of return earned by the first investor during the period for which the bond was held. [10 marks]

**QUESTION FOUR**

a.)An entrepreneur is considering a business project that will be financed by unrestricted loan(effectively an overdraft. The only outlay required is an initial cost of kshs.80,000.The income is received in arrears .At the end of the first year the income is expected to be kshs.8,800 and inflation is expected to increase each year thereafter by 10% pa compound. The entrepreneur may borrow and invest money at 12 % pa interest. If the project is expected to last for 12 years ,calculate :

i. The largest overdraft held during the term of the project [7 marks]

ii. The net present value of the project at 12% pa effective [3 marks]

iii. What is the accumulated profit at the end of the 12 years [2 marks]

b) An investor purchases a bond 3 months after issue.The bond will be redeemed at par 10 years after issue and pays coupons of 6 % per annum annually in arrears.The investor pays tax of 25% on both income and capital gains(with no relief for indexation)

i. Calculate the purchase price of the bond per $ 100 nominal to provide the investor with the rate of return of 8% per annum effective [6 marks]

ii. The real rate of return expected by the investor from the bond is 3% per annum effective.Calculate the annual rate of inflation expected by the investor [2 marks]

**QUESTION FIVE**

A pension fund has the following liabilities: annuity payments of £160,000 per annum to be paid annually in arrears for the next 15 years and a lump sum of £200,000 to be paid in ten years. It wishes to invest in two fixed-interest securities in order to immunize its liabilities. Security A has a coupon rate of 8% per annum and a term to redemption of eight years. Security B has a coupon rate of 3% per annum and a term to redemption of 25 years. Both securities are redeemable at par and pay coupons annually in arrears.

(i) Calculate the present value of the liabilities at a rate of interest of 7% per annum effective. [4 marks]

(ii) Calculate the discounted mean term of the liabilities at a rate of interest of 7% per annum effective. [5 marks]

(iii) Calculate the nominal amount of each security that should be purchased so that both the present value and discounted mean terms of assets and liabilities are equal. [9 marks]

(iv) Without further calculation, comment on whether, if the conditions in (iii) are fulfilled, the pension fund is likely to be immunized against small, uniform changes in the rate of interest. [2 marks]