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

**SCHOOL OF MATHEMATICS AND ACTUARIAL SCIENCE**

**UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE ACTUARIAL**

**4TH YEAR 1ST SEMESTER 2015/2016 ACADEMIC YEAR**

**REGULAR (MAIN)**

**COURSE CODE: SAC 405**

**COURSE TITLE: INVESTMENT AND ASSET MANAGEMENT 2**

**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 [30 marks]**

a)A company is liable to make four payments at 5 –yearly intervals, the first payment being due five years from now. The amount of tthpayment is $(1000 + 100 t).The company values these liabilities at an effective rate of 5% per annum. On this basis find:

i)The present value [4 marks]

ii)The DMT of these liabilities [4 marks]

b)An amount equal to the total value of the liabilities (on the basis of an effective annual interest rate of 5%) is immediately invested in two newly issued loans, one redeemable at the end of ten years and the other at the end of 30 years .Each loan bears interest at 5% per annum payable annually in arrears. Both loans are issued and redeemable at par. Given that , on the basis of an effective annual rate of 5%, the DMT of assets is the same as DMT of the liability. Determine how much is invested in each loan. [6 marks]

c) Explain how expectations theory can be modified by both ‘’liquidity preference’’ and ‘’market segmentation theories [6 marks]

d) Three bonds paying annual coupons in arrears of 7% and redeemable at 105 per $ 100 nominal reach their redemption dates in exactly one,two and three years time respectively.The price of each of the bonds is $98 per $ 100 nominal [5 marks]

 i)Determine the gross redemption yield of the 3 year bond

 ii)Calculate all possible spot rates implied by the information given

 e) A government bond pays a coupon half –yearly in arrears of $10 per annum. It is to be redeemed at par in exactly 10 years. the gross redemption yield from the bond is 6% per annum convertible half-yearly. Calculate the duration of the bond in years [5 marks]

 **QUESTION 2 [20 marks]**

An economist’s model of interest rates indicate that the n year spot rate of interest is 

i)Sketch a yield curve based on this formula,indicating clearly the values of the immediate spot rate and the limiting yield on long dated stocks [4 marks]

ii)Explain what is meant by the term structures of interest rates [3 marks]

 b)Explain briefly the shape of the yield curve by reference to the liquidity preference theory [5 marks]

c)Assuming that the economist’s model is correct, calculate:

i)The price of a bond, purchased now, paying coupons of 6% annually in arrears and redeemable at par in 3 years time [4 marks]

ii)The par yield for the bond in (a) [4 marks]

**QUESTION 3 [20 marks]**

a)The n –year spot rate of interest  is given by the formula:

 for n=1,2 and 3

(i)Calculate the implied one year forward rates applicable at times t=1 and t=2 [1 marks]

(ii)An investor purchases a 3 year bond that provides coupons of 6% pa payable in arrears and is redeemable at par. Show that the fair price for this bond is $104.36 per $ 100 nominal [1 mark]

(iii)Calculate the investor’s gross redemption yield [3 marks]

(iv)Calculate the par yield of the bond [3 marks]

b)The annual effective forward rate applicable over the period t to t+r is defined as  ,where t and r are measured in years. , , , .Calculate the following:

(i)  [2 mark]

(ii)All possible zero coupon bonds (spot) yields that the above information allows you to calculate[3 marks]

(iii)The gross redemption yield of a four year bond, redeemable at par with a 3% coupon payable annually in arrears [6 marks]

(iv)Explain why the gross redemption yield from the four –year bond is lower than the one year forward rate up to time 4,  [2 marks]

**QUESTION 4[20 marks]**

 a) An investor is considering the purchase of an annuity, payable annually in arrears for 20 years. The first payment is $ 1000.using a rate of interest of 8% per annum, calculate the DMT of the annuity when:

i) The payments increase at a rate of 10% per annum compound [3 marks]

ii) The payments increase by $ 100 each year [3 marks]

b).A pension fund has liabilities of $3 million due in 3 years time,$5 million due in 5 years time, $9 million due in 9 year’s time and $11 million due in 11 year’s time. The fund holds two investments X an Y .Investment X provides income of $ 1 million payable at the end of each year for the next 5 years with no capital repayment. Investment Y is a zero coupon bond which pays a lumpsum of $R at the end of n years. The interest rate is 8% pa effective.

i)Investigate whether values of $R and n can be found which ensures that the fund is immunized against such small changes in the interest rate [10 marks]

 ii)The interest rate immediately changes to 3% per annum effective. Calculate the revised present values of the assets and liabilities of the fund. Explain your answer [4 marks]

**QUESTION 5 [20 marks]**

a). Differentiate between a future contract and a forward contract [4 marks]

b).Consider a ten month forward contract on a stock with a pricw of $ 50.Assume that the risk free rate of interest(contiuously compounded) is 8% pa and the the term structure is flat.Also assume that dividends of $ 0.75 per share are expected after 3 months,6 months and 9 months.Calculate the present value of the dividends and use it to calculate the forward price [5 marks]

c.Consider a 6 month long forward contract on a non dividend paying stock.The risk free rate of interest(contiuously compounded) is 10% pa,the stock price is $ 25, and the delivery price .Calculate the forward price (F) and also determine the value of the forward contract [5 marks]

d.An investor entered into a long forward contract for $100 nominal of a security eight years ago and the contract is due to mature in four years time.The price per $100 nominal of the security was $94.50 eight years ago and is now $143.The risk free rate of interest can be assumed to be 5% pa effective throughout thee contract .Calculate the value of the contract now if it were known from the outset that the security will pay coupons of $9 two years from now and $10 three years from.You may assume no arbitrage [6 marks]