Date of Examination: 21/2/2023 Session: (FN/AN) FN Duration: 2 hrs. Full Marks: 30

Subject No.: HS50018 Subject: FIXED INCOME SECURITIES

Department/Center/School: Humanities and Social Sciences

Specific charts, graph paper, log book etc., required: None

Special Instructions (if any): (i) Answer all the questions. (ii) Use of non-programmable calculator is permitted. (iii) While answering all the necessary steps/calculations should be clearly shown. (iv) This question paper contains 2 printed pages.

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1. Determine the value of a five-year, zero-coupon bond with a face value of $1,000 given it is trading at the following yields 8%, 6%, and 10%. What are the percentage changes in value when the yield goes from 8% to 6% and when it goes from 8% to 10%? Comment on the price and interest rate relation you observe for this zero-coupon bond?

   [2]

2. Bond A is a 10-year, 10% coupon bond with a face value of $1,000 and annual coupon payments. The bond is currently priced at $1,064.18 to yield 9%. (i) Define the bond-equivalent yield. (ii) Explain how Bond A's bond equivalent yield is calculated. (iii) What is the importance of the bond-equivalent yield.

   [2]

3. The yield curve for AA-rated bonds is presently flat at a promised YTM of 9%. You buy a 10-year, 8% coupon bond with face value of $1,000 and annual coupon payments. Suppose your horizon is at the end of four years. What would your total return be given the following cases: (i) Immediately after you buy the bond the yield curve drops to 8% and remains there until you sell the bond at your horizon date. (ii) Immediately after you buy the bond the yield curve increases to 10% and remains there until you sell the bond at your horizon date. (iii) What type of risk is your investment subject to? How could the risk be minimized?

   [2]

4. What is Duration and Convexity of a bond. Mathematically, derive the Duration, Modified Duration and Convexity measures

   [3]

5. Suppose an investor bought a 10-year, 10% annual coupon bond at par (face value of $1,000 and paying coupons annually) and then sold it 3.5 years later at a yield of 8%. Determine the full price, clean price, and accrued interest the investor would receive when he sold the bond. Use a 30/360 day count convention.

   [3]

6. (i) Using the average rate to maturity (yield approximation formula) approach, estimate the YTM on a 20-year, 7% annual coupon bond, with a face value of $1,000, annual coupon payments, and currently priced at $901.82. What is the value of the bond using the ARTM as the discount rate? Suppose the 20-year, 7% annual coupon bond in question 5 (i) had a call option giving the issuer the right to buy the bond back after five years at a call price of $1,000. Given the bond is priced at $901.82, estimate its yield to call using the yield approximation formula (average rate to call, ARTC) approach.

   [3]

7. Given a current annual spot rate of $S_0 = 6\%$, upward and downward parameters on the spot rate of $u = 1.2$, $d = 1/1.2$, and probability of the spot rate increasing in one period of $q = 0.5$:
   a. Determine the value of a three-year, option-free, 6% annual coupon bond with $F = \$100$.

b. Determine the value of the 6% bond assuming it is callable at a call price of CP = 98. Use the minimum constraint approach as well as alternative binomial valuation approach. [3]

8. Calculate the following measures for bond A (assume that the bond pays interest semiannually):

	A
Coupon	9%
Yield to maturity	8%
Maturity (years)	5
Par	$100
Price	$104.055

(i) Price Value of a Basis Point (PVBP); (ii) Macaulay Duration; (iii) Modified Duration; (iv) The Approximate Duration by changing yields by 20 basis points and compare your answer with the convexity measure calculated in part (iii); (v) Convexity Measure; (vi) The Approximate Convexity Measure by changing yields by 20 basis points and compare your answer to the convexity measure calculated in part (v). [12]

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