

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF COMMERCE
DEPARTMENT OF FINANCE
BACHELOR OF COMMERCE HONOURS DEGREE IN FINANCE
PART I- 2ND SEMESTER SUPPLEMENTARY EXAMINATION – AUGUST 2006
FINANCIAL MATHEMATICS II CFI 1201
TIME ALLOTTED: 3 HOURS 10 MINUTES

INSTRUCTIONS

1. **The paper is 3 hours 10 minutes, of which 10 minutes is reading time.**
2. **Attempt question 1 and 3 others.**
3. **Question 1 carries 40 marks.**
4. **Electronic calculators may be used**
5. **Write legibly.**

Question One [40 marks]

NUST Pension Fund has an obligation of \$10 000 000, which is not indexed against inflation, due at the end of 3 years. It has decided to discharge the obligation by purchasing today, a portfolio of government bonds with a yield to maturity of 30% p.a.

- 1.1 Calculate the present value of the portfolio of government bonds. [5 marks]
- 1.2 What is the duration of the future obligation? [5 marks]
- 1.3 Calculate the convexity of the future obligation. [8 marks]
- 1.4 Explain, fully, a strategy that the Pension Fund could employ, in respect of the portfolio of government bonds, to hedge the future obligation against interest rate risk. [5 marks]
- 1.5 Use the concept of Duration and Convexity to calculate the dollar sensitivity of the value of the Portfolio to a 2% points rise in yield to maturity. [8 marks]
- 1.6 Suppose the portfolio of government bonds pays an annual coupon of 25% on a par value of \$1 000, calculate the realized yield following the 2% points, and only, rise in yield to maturity, if maturity of the Portfolio is 4 years. [9 marks]

Question Two [20 marks]

- 2.1 Show that the covariance of an asset [say k] with a Portfolio containing the asset is a value weighted average of the covariances of the asset and individual assets in the portfolio. [10 marks]
- 2.2 A Portfolio comprises 3 securities, X, Y and Z. The portfolio weights of X and Y are 50% and 70% respectively.
 - 2.2.1 What is the implied weight of security Z? What is its significance? [4 marks]

- 2.2.2 Calculate the covariance of security X with the Portfolio if the variance of X is 30% and the covariances of X with Y and X with Z are 10% and 20% respectively. **[6 marks]**

Question Three **[20 marks]**

You are considering two investment strategies over your horizon date of 2 years. The first is to purchase a one year maturity, government bond, whose one year spot yield is 20%, and roll forward the investment at the end of the first year.

The second strategy is to purchase a government bond with a maturity of 2 years - your horizon date. The spot yield to maturity on this bond is 25%.

- 3.1 What is the observed one year forward rate at the beginning of year 2? **[7 marks]**
- 3.2 Suppose the expected one year spot rate at the beginning of year 2 is 22%, which strategy is more profitable? Explain **[6 marks]**
- 3.3 What is the yield curve implication of the decision taken in 3.2 above? **[7 marks]**

Question Four **[20 marks]**

- 4.1 Derive, from first principles, the no-arbitrage, cost of carry, Futures Valuation Model, for Ordinary Stock, highlighting the critical assumptions. **[13 marks]**
- 4.2 Delta stock which is currently trading at \$20 000 has proposed an interim dividend of \$1 500 per share payable in 91 days. The yield on 91 day Treasury Bills is 100%. Calculate the 91 day forward price of Delta stock. Assume a 365 day-year. **[7 marks]**

Question Five **[20 marks]**

- 5.1 The Consumer Price Index Level is 2 800 in Zambia and 5 000 in Zimbabwe. Calculate the exchange rate, using the Direct quote in Zimbabwe, based on the absolute version of the Purchasing Power Parity Theory [PPPT]. **[3 marks]**
- 5.2 Derive, from first principles, the International Fisher effect for forecasting foreign exchange rates. **[10 marks]**
- 5.3 What are the limitations of the Parity conditions, used in "5.1" and "5.2", to forecast exchange rates? **[7 marks]**