# NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
## FACULTY OF COMMERCE
### DEPARTMENT OF FINANCE
## BACHELOR OF COMMERCE HONOURS DEGREE IN
### Finance, Banking, Marketing
### Insurance and Risk Management
PART I - 2ND SEMESTER SUPPLEMENTARY EXAMINATION – AUGUST 2007
## <u>FINANCIAL MATHEMATICS II [CFI 1201]</u>
### TIME ALLOTTED:  3 HOURS 10 MINUTES
<u>INSTRUCTIONS</u>

1. **The paper is 3 hours 10 minutes of which 10 minutes is reading time. Candidates may write on the question paper but shall not write in the answer book during reading time.**
2. **Attempt question 1 and 3 others.**
3. **Question 1 carries 40 marks.**
4. **Electronic calculators may be used.**

<u>Question One</u>                              **[40 marks]**

A bond has face value of $1 000, fixed coupon rate of 20% per annum, yield to maturity of 25% per annum and maturity date of June 1 2012.  It pays coupons bi-annually on June 1 and December 1.

1.1    Calculate the Dirty and Clean Price if settlement date is April 15 2007 and the sale is ex interest.                              ***[10 marks]***

1.2    What is the realized yield if soon after purchasing the bond on April 15 2007, the yield to maturity rises to 27% per annum and remains at this level to investment liquidation date of June 1 2009.             ***[7 marks]***

1.3    Calculate the Duration and convexity of the Bond in ½ years.     ***[7,7 marks]***

1.4    Suggest a strategy for immunizing the bond against interest rate risk.  Under what circumstances is your strategy suitable?             ***[5,4 marks]***

<u>Question Two</u>                              **[20 marks]**

2.1    What are the critical assumptions of parity conditions in money and foreign exchange markets?                              ***[5 marks]***

2.2.    Show that under the conditions in 2.1 above

$$\frac{S_t}{S_{t-1}} = \frac{1+ i_h}{1+ i_f}$$

***Where:***

$S_t$          =          future spot.

$S_{t-1}$          =          Current spot exchange rate.

$i_h$          =          inflation rate of the pricing currency.

$i_f$          =          inflation rate of the priced currency.             ***[7 marks]***

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2.3 The spot USD: sterling exchange rate in the Eurocurrency market is US$2.00 and the forward exchange rate for 3 months is US$2.200. In the same market US$ and sterling interest rates are:6% and 4% per annum respectively. Show that an opportunity for Arbitrage profit exists and determine the profit. If you have the capacity to borrow 100 000 units in either currency. **(4, 9 marks)**


**Question Three**        **(20 marks)**

3.1 Show that the covariance of an **ith** asset with a portfolio (P) containing the **ith**

asset is $\sigma_{ip} = x_i\sigma_i^2 + \sum_{\substack{j=1 \\ i\#j}}^{N} x_j\sigma_{ij}$

**Where**:       $\sigma_{ip}$      =      covariance of **ith** asset with portfolio.

              $x_i \ and \ x_j$      **=**      weights placed on **ith** and **jth** asset in the portfolio.

              $N$      =      number of assets in the portfolio.

              $\sigma_{ij}$      =      covariance between **ith** and **jth** assets.

*[9 marks]*

3.2 A Portfolio comprises 4 securities – A, B, C and D. The portfolio weights of A, B, and C are 30%, 40% and 50% respectively.

     3.2.1 What is the implied weight of security D? Explain.      *[3 marks]*

     3.2.2 What is the covariance of security A with the Portfolio if the variance of A is 20% and the covariances of A with B, A with C and A with D are 25%, 30% and 15% respectively.      *[8 marks]*


**Question Four**        **[20 marks]**

4.1 The current level of the Zimbabwe Stock Exchange [ZSE] Industrial Index is 50 000. Its annual volatility is 40%. The 91 day TB rate is 30%. You have been asked to value a European put option on the Index whose exercise price is equal to the current index level and whose expiry is 3 months. Using Binomial method and assuming 2 equal intervals to expiry, Calculate the value of the European put. *[14 marks]*

4.2 A call option on a non-dividend paying stock will never be exercised before expiry date. Explain. *[6 marks]*

## Question Five                    (20 marks)

You are faced with two possible Bond Investment Strategies over your Horizon date of two years.

**Strategy A,**    is to purchase, initially, a 1 year maturity Bond and roll forward the investment at end of the first year for another year.

**Strategy B,**    is to purchase a Bond with same credit risk as in **Strategy A** Bond but whose maturity is equal to your Horizon Date of 2 years.


The spot interest rates [yields to maturity] of 1 year and 2 year maturities are 20% and 25% respectively.

5.1    Calculate the guaranteed forward interest rate for 1 year at the beginning of year 2.                                                                                  *[7 marks]*

5.2    Suppose the expected 1 year spot rate at the beginning of year 2 is 22%, which strategy should you follow.  Explain.                              *[6 marks]*

5.3    What is the yield curve implication of the strategy you adopted in 5.2.
                                                                                          *[7 marks]*