NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF COMMERCE
DEPARTMENT OF FINANCE

B.COMM (HONOURS) DEGREE IN FINANCE

FINANCIAL MATHEMATICS II – CFI 1201

AUGUST 2010 - SECOND SEMESTER SUPPLEMENTARY EXAMINATIONS

DURATION: 3 HOURS

Instructions to Candidates

1. **Attempt all TWO (2) Questions from SECTION A**

2. **Attempt ANY THREE (3) Questions from SECTION B**

3. **To Obtain Full Marks Show ALL appropriate steps to your answers**

Requirements : Non-programmable Scientific calculator

SECTION A [COMPULSORY – 40 MARKS]

QUESTION ONE

(i) Define the following terms as used in financial mathematics:

    a) Price risk   [1 mark]

    b) Call risk   [1 mark]

    c) Systematic risk   [2 marks]

    d) Convexity   [2 marks]

(ii)

    a) With the aid of a labeled diagram demonstrate how an investor may achieve Efficient diversification   [4 marks]

    b) List the main assumptions of the Capital Asset Pricing Model (CAPM)   [3 marks]

    c) YTM on bond is expected to move from 10.3% to 10%. If the bond has a 10 year duration, what is the expected percentage price change   [4 marks]

    d) Given the following information about market portfolio (m) and a bond in the market (i):

    $\sigma_i = 5\%$, $\sigma_{im} = 10\%$, $R_m = 7\%$, $D_m = 10$ years and $D_i = 5$ years

    Calculate the Beta for the Bond (β_i)   [4 marks]

[Total 20 Marks]

QUESTION TWO

A Government loan stock has the following features:

- Face value   =   1000
- Coupon   =   20%
- Maturity date   =   Dec 31 2010
- Coupon dates =   June 30 and Dec 31

You purchase the loan stock cum interest on April 18, 2006 when yield to maturity is 24% and sell it ex interest on December 10 2009 when yield to maturity is 18%

Calculate:

a) Dirty price of bond at purchase   [8 marks]

b) Dirty price of bond at sale   [6 marks]

c) Realized yield for the bond investment. [6 marks]

[Total 20 Marks]

SECTION B – ANSWER ANY THREE QUESTIONS [60 MARKS]

QUESTION THREE

A bond investor has a HD of 4.24 years. He purchases a bond on its interest date, with a yield of 9% maturing in 5 years at a price of $ 1000 and sells it at his HD of 4.24 years cum interest.

a) An investor holds a portfolio of fixed interest securities to meet future liabilities. State the conditions that need to be met if the investor is to be immunised from small, uniform changes in the rate of interest. [2 marks]

b) Calculate the Realised Yield if yield curve falls from 9% to 7% immediately after purchase and remains at this level to Horizon date.   [5 marks]

c) Calculate the Realised Yield if yield curve rises from 9% to 11% immediately after purchase and remains at this level to Horizon date.   [5 marks]

d) Calculate the duration and convexity of the bond.   [8 marks]

e) Comment on your results in (b), (c) and (d) and outline how an investor can arbitrage with convexity. [2 marks]

[Total 20 Marks]

QUESTION FOUR

(i) Given three assets A, B, C and D in the table bellow; compute the variables indicated by the question marks.

Outcome	Probability	R_A	R_B	R_C	R_D
1	.25	24%	28%	4%	10%
2	.50	12%	12%	8%	0%
3	.25	0%	4%	28%	-10%
$\overline{R}$		12	14	12	? [1]
σ^2		72	76	88	? [3]
σ		8.49	8.72	9.38	? [2]
X_i		0%	55%	40%	5%
σ_{BD}	? [3]				
σ_{CD}	? [2]				
ρ_{BC}	? [3]				
E_P	? [2]				
σ_P	? [4]				

[Total 20 Marks]

QUESTION FIVE

(i) With the aid of examples, distinguish between the money market and capital market for securities   [10 marks]

(ii) Given the following table for the sport rate and the time to maturity for Bonds on the market.

Spot Rate	TTM
20%	1
30%	2
35%	3

Calculate the following:

(a) The implied Forward rate for 1 year at the beginning of year 1.   [2 mark]

(b) The implied forward rate for 2 years at the beginning of year 2.   [3 marks]

(c) The 1-year forward rate at the beginning of year 3.   [3 marks]

(ii) Suppose your HD is 2 years and you expect the future rate for 1 year at the beginning of year 2 to be 45%, what is the implication for term structure of interest rates in (i) above? [4 marks]

[Total 20 Marks]

QUESTION SIX

(i) Distinguish between a forward and a futures contract [4 marks]

(ii) Using an ideal arrangement of a futures contract illustrate the important role played by the clearing house in futures contracts. [6 marks]

ANSWER EITHER (iii) OR (iv)

(iii) Tee Cee, founder and president of Hutmore Investments, is wondering whether the company should make its first public sale of common stock and if so at what price. The company's financial plan envisages rapid growth over the next 3 years but only moderate growth afterwards. Forecast earnings and dividends are as follows:

Year:	1	2	3	4	5	6	7	8
Earnings per share	$2.45	3.11	3.78	5% growth thereafter				
Dividends per share	$1.00	1.20	1.44	1.73	5% growth thereafter			

What is the fair price for the stock if investors require a return of 10% and a price-earnings ratio of 8. [10 marks]

OR

(iv) An investor owns a block of shares that is expected to pay a dividend of amount D in one year's time; dividends in each future year are expected to be $100j$ % higher than in the previous year. Derive an expression for the present value of the proceeds from this investment, calculated using an interest rate i and assuming the shares will be held for 10 years. [10 marks]

[Total 20 Marks]