NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF INSURANCE AND ACTUARIAL SCIENCE

B.COMM (HONS) DEGREE IN ACTUARIAL SCIENCE

AUGUST 2009 EXAMINATIONS

SUBJECT: INTRODUCTION TO DERIVATIVES (CIN 4215)

TIME ALLOWED: 3 HOURS

INSTRUCTIONS TO CANDIDATES

   1   Answer all 6 questions.
   2   Write clearly and begin each question on a new page.
   3   In addition to this paper a candidate should have a **copy of 2002 EDITION
          actuarial tables** and a non-programmable scientific calculator.

Q1   (a) Identify and explain the factors that affect the value of an option.   [5 marks]

       (b) Illustrate clearly the payoff diagrams for the following:
                (i)   Long straddle
                (ii)   Short call
                (iii)   Short put
                (iv)   Long put
                (v)   Short strangle   [5 marks]
                                                          [Total 10 marks]

Q2   Suppose the current underlying stock price $S_0 = \$50$. Prices are assumed to go up
       by 25% or go down by 25%. Suppose also that the expiry period is split into two
       periods, the risk-free rate of interest is 10% per annum and that the exercise price,
       X = \$40. Using the (i) binomial risk neutral approach and (ii) binomial hedge
       ratio approach, calculate the value of the European put option today.
                                                                    [10 marks]

Q3   (i) Explain the following derivative terms:
       (a) Marking to market
       (b) European and American options
       (c) Initial and variation margin
       (d) In-the –money and out-of-the-money call option
       (e) Role of the clearing house.   [5marks]
       (ii) What are differences between forward, futures and option contracts?
                                                          [10marks]

(iii) A long forward contract on a non-dividend paying stock was entered into some time ago. It currently has 6 months to maturity. The risk-free rate of interest (with continuous compounding) is 10% per annum, the stock price is $25, and the delivery price is $24. Calculate the value of the forward contract.   [5 marks]

[Total 20 marks]

Q4   You are given the following information:

Option	Time	Exercise Price(X)	Price
S&P100 Index Call	1 month	240	5,25
S&P100 Index Put	1 month	240	8,50

The current price of the S&P100 Stock Index = 238,20 and the risk-free rate of interest is 0.28% per month (ie. 28 basis points).

(a)   Determine if an index arbitrage opportunity exists.   [5 marks]

(b)   What action should you take in order to earn this arbitrage profit?

[5 marks]

(c)   Show the cash flows of the arbitrage transactions at time 0 and at time T given that Stock Price is 200 and 300.   [10 marks]

[Total 20 marks]

Q5   Suppose that an investor has a Portfolio valued at $ 100 000 and that he wishes to protect it from falling below this value but does not want to forego the chance of benefiting if the portfolio rises above this level. Suppose we know that after 6 months the portfolio could have risen in value to $ 110 000 or fall in value to $ 90 000. Also suppose that if it had risen to $ 110 000, then after a further 6 months the portfolio could have risen to $ 120 000 or fallen to $ 100 000; while if it had fallen to $ 90 000 after 6 months, then by the end of the year, it could have risen to $ 100 000 or fallen to $ 80 000.
Assuming that the riskless security has a semi-annual interest rate of 5% ,

(a) Allocate through dynamic asset allocation the initial investment into risky assets and risk free assets in order to achieve the desired year end portfolio. Comment briefly on your strategy.   [15 marks]

(b) In hedging financial risks, when should you use options in preference to futures.   [5 marks]

[Total 20 marks]

Q6   (a)   Derive the Black-Scholes model for pricing a European call option.

[15 marks]

(b)   Identify the assumptions underlying this model.   [5 marks]

[Total 20 marks]

!!!!!!!!!!!!!!!!!!!!!!!END OF EXAMINATION!!