INSTITUTE OF ACTUARIES OF INDIA

EXAMINATIONS

18th November 2011

Subject CT8 – Financial Economics

Time allowed: Three Hours (10.00 – 13.00 Hrs)

Total Marks: 100

INSTRUCTIONS TO THE CANDIDATES

1. *Please read the instructions on the front page of answer booklet and instructions to examinees sent along with hall ticket carefully and follow without exception*

2. *Mark allocations are shown in brackets.*

3. *Attempt all questions, beginning your answer to each question on a separate sheet. However, answers to objective type questions could be written on the same sheet.*

4. *In addition to this paper you will be provided with graph paper, if required.*

5. *Please check if you have received complete Question Paper and no page is missing. If so kindly get new set of Question Paper from the Invigilator*

AT THE END OF THE EXAMINATION

Please return your answer book and this question paper to the supervisor separately.

Q. 1) Assume an investor has initial wealth of 1 unit and his utility function has the following form

$$U(w) = \frac{w^{\gamma} - 1}{\gamma} \text{ for } w > 0$$

i) For what values of γ will the investor be considered as risk averse? (2)

ii) Explain what is meant by an iso-elastic utility function and prove that the investor's utility function is iso-elastic. (3)

A risky investment Z has the following characteristic.

Return	Probability
-10%	0.5
+20%	0.5

iii) α is defined as the amount invested in Z (the remaining wealth is held in the form of cash or cash equivalents). Derive an expression for α in terms of γ in order to maximise the expected utility of the investor. Hence or otherwise calculate the amount of wealth invested that should be invested in Z for $\gamma = -3$. (9)

iv) Calculate the amount of wealth that should be invested in Z for $\gamma = -1$, -5 *and* -7. Comment on the risk averse nature of the investor corresponding to the values of γ. (3)

v) Use the iso-elastic nature of investor's utility function to calculate the amount of wealth invested in Z for $\gamma = -3$ if initial wealth is 500 units. (3)

[20]

Q. 2) **i)** State any four difficulties faced when testing the EMH. (2)

ii) Describe briefly the evidence for or against each form of EMH? (6)

[8]

Q. 3) Assume CAPM holds in the following market.

The market consists of 3 risky securities X, Y, Z. Standard deviation of annual returns of these three securities is 45%, 30% and 15% respectively. The market capitalization of these securities is in the same proportion as their standard deviation.

The risk-free rate of interest is 10%.

The correlation coefficients between the returns is given the table below.

Pair	Correlation
X, Y	0.75
Y, Z	0.20
X, Z	-0.10

i) Derive the covariance matrix for the returns on X, Y and Z. (3)

ii) Calculate the expected returns of X, Y and Z if the expected return on the market portfolio is 30%. (7)

iii) Discuss the main problems involved in estimating parameters for asset pricing models. (5)

[15]

Q. 4) The price of a non-dividend paying share is given by the following equation:

$$S_t = S_0 e^{\mu t + \sigma B_t}$$

Where $\{B_t, t \geq 0\}$ is a standard Brownian motion and μ and σ are constants.

i) State ito's lemma and hence derive the expression for stochastic differential equation for St. (3)

ii) Derive the expressions for expected value and variance of St. (4)

[7]

Q. 5) **i)** What is meant by the "Theta of an option is -0.1"? (1)

ii) For a option writer what is the risk of having a delta neutral portfolio which has a large negative Gamma? (3)

iii) Your company holds a 4-month put option on XYZ share index. The current value of the index is Rs. 555 and strike price is Rs. 545. The dividend yield is 3% per annum (with continuous compounding) and volatility of the index is 25% per annum (with continuous compounding) . Calculate the Option's Rho. You can assume risk free rate at 8% per annum. Assume that the market prices the options using Black-Scholes formula. (6)

iv) You are told that the risk-free interest rate should have been 10% per annum instead of 8% per annum (as given in iii). Without going through the full calculations, how would you arrive at the new value of the option? (2)

[12]

Q. 6) **i)** Explain the difference between a recombining and a non-recombining binomial tree. (2)

ii) A non-dividend paying stock has a current price of INR 100. In any unit of time the price of the stock is expected to increase by 10% or decrease by 5%. The continuously compounded risk-free interest rate is 4% per unit of time. A European call option is written with a strike price of INR 103 and is exercisable after two units of time, at t = 2.

Establish, using a binomial tree, the replicating portfolio for the option at the start and end of the first unit of time, i.e. at t = 0, 1. Hence, calculate the value of the option at t = 0. (6)

[8]

Q. 7) **i)** List six factors that affect stock option prices (2)

ii) Explain the impact of increase of each these variables on the price of a European Call and American Put option. Assess each independently while assuming others to be fixed. (4)

iii) You have purchased a two-month call option for Rs 6 with a strike priced Rs 60. It is rumored that the company is going to make a major announcement over the next two month which will cause a large movement in the share price.

Your trader friend suggests that you to buy a put option with the same strike price and expiry which will cost you Rs. 4? Construct the table to show the how profit will vary with movement in stock price and why will this strategy work? (6)

[12]

Q. 8) **i)** What are the 3 main limitations of one factor model? (3)

ii) Compare the Vasicek and Hull & White models of interest rates. (5)

iii) Given that short rate is 4% and standard deviation is 1% per annum, calculate the S.D when the short rate increases to 8% in.

(a) Vasicek's model
(b) Cox Ingersoll Ross Model

(2)

[10]

Q. 9) **i)** Explain the term recovery rate for a bond? (1)

ii) A corporate bond yields 200 basis points more than the similar risk free bond and the expected recovery rate is 40%. What is the probability of default given that there are no defaults in earlier year? (2)

iii) A company has just issued a zero-coupon bond of nominal value 1 crore with maturity of 10 years. The value of the company's asset is INR 35 crores and the volatility of its assets is 80% per annum (with continuous compounding). The constant risk free rate is assumed to be 5% per annum compounded continuously. Company is expected to wound up after 10 years when the assets will be used to pay off the bond holders and rest being distributed to the equity holders. Assume that the equity of the company is valued using Black-Scholes formula.

Calculate the credit spread of the debt for the zero coupon bond (5)

[8]

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