

**M.Sc. (ACTUARIAL SCIENCE)**

**Term-End Examination 00243**  
**December, 2012**

**MIA-011 (F2F) : FINANCIAL ECONOMICS**

*Time : 3 hours*

*Maximum Marks : 100*

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**Note : Answer any 10 questions. Each question carries 10 marks.**

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1. A stock price is currently at Rs. 100. In the next 3 months it is expected to go up or down by 4%. The risk-free rate of interest is 6% p.a. with continuous compounding. It is likely that the rate of volatility may continue for another 3 months at the same rate.
- (a) What is the value of a six-month European call option with a strike price of Rs. 102 ? 5
- (b) What is the value of a six-month European put option with a strike price of Rs. 102 ? 3
- (c) Verify that the European call option and European put option prices satisfy the put call parity. 2

2. The following options are available with an investor to invest in an asset.

State	Return	Probability
1	10%	0.5
2	20%	0.3
3	50%	0.2

Calculate the following.

- (a) Variance of return 4
- (b) Semi variance of return 3
- (c) Short fall probability with a bench mark return of 22% 3
3. An investor has the following options to invest. 10

State	Probability	Asset		
		A	B	C
1	0.2	5%	5%	6%
2	0.3	5%	12%	5%
3	0.1	5%	3%	4%
4	0.4	5%	1%	7%

Market capitalisation 10,000 17,546 82,454  
 Determine the market price risk assuming CAPM holds.

4. (a) Explain the benefits of diversification. 2
- (b) State the assumptions used in modern portfolio theory on investor's behaviour that are necessary to specify efficient portfolios. 3

- (c) An investor can construct a portfolio using two assets X and Y.

	Assets	
	X	Y
Expected return	12%	8%
Variance of return	30%	15%
Correlation coefficient between X and Y	0.5	

Assume that the investor cannot borrow to invest.

- (i) Determine the composition of portfolio which will give the investor highest expected return. 2
- (ii) Calculate the composition of portfolio which will give the investor the minimum variance. 3
5. (a) State the 3 forms of efficient market hypothesis. 3
- (b) What do you understand by active investment management and passive investment management ? 4
- (c) State the reasons why it is hard to test each of the 3 forms at (a) hold in practice. 3

11. (a) Explain why an investor might want to vega-hedge a portfolio. 3
- (b) A European call option on a stock has exercise date one year, a strike price Rs. 320, current price Rs. 350, continuously compounded risk-free interest rate 4% p.a. and volatility of stock price 0.5% p.a. Assuming Black-scholes model estimate the option price. 7
12. List eight desirable characteristics of a term structure model. Write any two limitations of one factor term structure models. 8+2
13. State the Stochastic Differential Equations for the short rate  $r(t)$  in the following models : 3+7
- (a) Vasicek model
- (b) Cox - Ingersoll - Ross (CIR) model
- (c) Hull and White model
- Compare the above models.
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6. (a) State first order stochastic dominance and second order stochastic dominance. What is the difference between them ? **4+2**
- (b) What are the main advantage and disadvantages of using stochastic dominance to make investment decisions ? **4**
7. (a) State and prove : (i) scaling property of Brownian motion and (ii) time inversion property of Brownian motion. **3+3**
- (b) State geometric Brownian motion model. What is the advantage of geometric Brownian motion model over Brownian motion model ? **2+2**
8. The price of 3 months European call option on a dividend paying share is 'c'. The strike price is Rs. 130, current share price is Rs. 128, dividend rate 2% is expected in one month and risk free interest rate is 5% p.a.
- (a) Derive the upper and lower bounds on the price of European call option. **5**
- (b) The price of a European put option with the same underlying share, the same strike price and the same maturity time is Rs. 1.25. Calculate the price of the above European call option. **5**

9. (a) Define Delta, Gamma, Theta, Vega and Rho for an individual derivative security. 5
- (b) State the put-call parity for a non-dividend paying share with the same strike price and maturity time. Use this parity and calculate the Delta and Gamma of a European put option. 1+2+2

10. (a) Discuss the differences between risk-neutral and real-world probability measures in the context of the valuation of derivative securities using binomial model. 3
- (b) Consider a two period binomial model for a non-dividend paying stock whose current price is Rs. 100 and continuously compounded risk-free interest rate 5% per six month period. Over each six month period, the stock price can either go up or go down by 20%. 7

Calculate the price of a standard European call option on the stock with strike price Rs. 100 and maturity one year.