FINANCIAL ENGINEERING
ASSIGNMENT – 2

1. Let S(T) be the price of stock at time T. All of the following options have exercise time T and strike price K. Give the payoff at time T that is earned by an investor who owns
   (i) One call and one put option.
   (ii) Two calls and has sold short one share of stock.
   (iii) One share of stock and has sold one call.
   (iv) One call having strike price K_1 and has sold one put having strike price K_2.

2. A certain stock is selling for $Rs\ 50$. The feeling is that for each month, for the next two months, the stock price will rise by 10% or fall by 10%. Assuming that the risk free rate is 1%, calculate the price of the European call with the strike price of $Rs\ 48$.

3. Consider the data $S(0) = 60, K = 62, u = 1.1, d = 0.95, r = 0.03\ and\ T = 3$. Find $C^E(0)$ and $P^E(0)$.

4. Let $S(0) = 120, u = 1.2, d = 0.9\ and\ r = 1\%$. Consider a call option with strike price $K = 120\ and\ T = 2$. Find the option price and the replicating strategy.

5. A non-dividend paying stock is currently selling at Rs.100 with annual volatility 18%. Assume that the continuously compounded risk-free interest rate is 4%. Using a two-period CRR binomial model , find the price of one European call option on this stock with strike price of Rs.80 and time to expiration 3 years.

6. Consider the following data: $S(0) = Rs.51,\ K = Rs.50,\ \sigma = 30\%,\ r = 8\%$. Assuming the Black-Scholes framework and that the stock pays no dividend, compute 3-months European call price and 3-months European put price using the Black-Scholes formula. Also compute the put price using the put-call parity. Are the two values same?

7. The price of a stock is Rs.260. A 6-month European call option on the stock with strike price Rs.256 is priced using Black-Scholes formula. It is given that the continuously compounded risk-free rate is 4%; the stock pays no dividend; the volatility of the stock is 25%. Determine the price of the call option.

8. You own 100 shares of a stock whose current price is Rs.42. You would like to hedge your downside exposure by buying 6-month European put option with a strike price of Rs.40. It is given that the continuously compounded risk-free rate is 5%; the stock pays no dividends; the stock volatility is 22%. Assuming the Black-Scholes framework determine the cost of the put option.

9. Consider purchase of 100 units of 3-month Rs.25-strike European call option. It is given that the stock is currently selling for Rs.20; the continuous compounding risk free interest is 5%; the stocks volatility is 24% per annum. If the stock pays dividends continuously at the rate of 3% per annum, determine the price of block of 100 call options, assuming the Black-Scholes framework.

10. The current price of stock is Rs.100 and its volatility is 25% per year. The risk free interest rate is 5% per annum. A portfolio is constructed consisting of one 6-month European call option with strike price of Rs.80 and the cash obtained from shorting D shares of stock. The portfolio value is non-random. What is D?