**JAIPURIA INSTITUTE OF MANAGEMENT, INDORE**

**PGDM**

**FOURTH TRIMESTER (Batch 2021-23)**

**END TERM EXAMINATION, NOV-2022**

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| --- | --- | --- | --- |
| Course Name | **Financial Derivatives and Risk Management** | Course Code | **40223** |
| Max. Time | **2 hours** | Max. Marks | **40** |

**INSTRUCTIONS:**

***Answer all questions.***

**Questions.1 (8 Marks)**

Theta holds 10,000 Gamma stock shares, currently selling at Rs. 2000 per share. Theta will be required to sell all his holdings of Gamma stock after two months to finance the marriage of his daughter. Over the past year, the Gamma stock has appreciated 40 percent. Theta believes that Gamma stock is overvalued when measured by several traditional fundamental/economic indicators. He is concerned about maintaining the excellent gains the stock has experienced in the past year but recognizes that the Gamma stock could still move above its current price of Rs. 2000 per share.

Theta is considering the following option collar strategy:

* Protection for the investment in Gamma stock can be attained by purchasing 10,000 two-month European put options on Gamma stock with an exercise price of Rs. 2000. These puts currently sell for Rs. 100 each.
* The put can be financed by selling 20,000 two-month European call options on Gamma stock with an exercise price of Rs. 2200. These calls currently sell for Rs. 50 each.

Describe the potential return of the combined portfolio (investment in the spot market plus the options collar) if, after three months, the price of Gamma stock has:

1. risen by 12 percent to Rs. 2240
2. remained at Rs. 2200 (no change)
3. declined by 12% to Rs. 1760.

Show full working.

**Questions.2 (5 Marks)**

An Airline company requires 4 million gallons of jet fuel in one month and decides to use heating oil futures for hedging. The correlation coefficient between the monthly change in the spot price of jet fuel and the monthly change in the futures price of heating oil is 0.95. The standard deviation of the monthly change in the spot price of jet fuel is 0.090, and the standard deviation of the monthly change in the futures price of heating oil is 0.095. Each futures contract on heating oil futures is on 40,000 gallons of heating oil.

* 1. What is the optimal hedge ratio?
  2. How many heating oil futures contracts should be bought or sold to hedge the price risk involved in buying jet fuel after one month? Explain your answer.

**Questions.3 (8 Marks)**

The result of a major lawsuit affecting Delta Limited is due to be announced within two months. The current share price of Delta Limited is Rs. 2500 per share. If the ruling is favorable, it is expected that there will be a large increase in the share price of Delta Limited. If the ruling is unfavorable, it is expected that there will be a large decline in the share price of Delta Limited. To exploit the uncertainty of the outcome, Danish considers the following two investment strategies.

Strategy A is to use a straddle purchase strategy with an exercise price of Rs. 2500 and a time to expiration-of two months. A two-month European call option on Delta stock with a strike price of Rs. 2500 costs Rs. 100. A two-month European put option on Delta Stock with a strike price of Rs. 2500 costs Rs. 75.

Strategy B is to create a strangle purchase strategy by using strike prices of Rs. 2400 and Rs. 2600. A two-month European put option on Delta Stock with a strike price of Rs. 2400 costs Rs. 60. A two-month European call option with a strike price of Rs. 2600 costs Rs. 80.

1. What is the pattern of profit from Strategy A? For what stock price range of Delta after one month would Strategy A give profit? Explain your answer.
2. What is the pattern of profit from Strategy B? For what stock price range of Delta after one month would Strategy B give profit? Explain your answer.
3. Which strategy is riskier? Why?
4. If Danish believes that there will be a minimum variation of 15% in either direction in the share price of Delta Limited after the outcome of the case, which strategy would Danish prefer? Why?

**Questions.4 (8 Marks)**

Consider a portfolio with a delta of -1000, a gamma of -10,000, and a vega of -4000. The options shown in the table below can be traded.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Delta | Gamma | Vega |
| Option 1 | 0.7 | 1.0 | 1.0 |
| Option 2 | 0.6 | 1.6 | 0.6 |

How could the portfolio be made Delta, gamma, and vega neutral? Explain your answer and show full working.

**Questions.5 (6 Marks)**

The current price of ACC stock is Rs. 1600 per share. At the end of 3 months, the share price of ACC stock is expected to go up by 5% or decline by 5%. The risk-free rate of interest is 5% per annum with continuous compounding. Assume that ACC is not expected to pay any dividend in 3-months.

* 1. What is the value of a 3-month European call option on ACC stock with an exercise price of Rs. 1610 using the binomial model? Explain your answer.
  2. What is the value of a 3-month European put option with an exercise price of Rs. 1610 using the binomial model? Explain your answer.
  3. Confirm that solutions for values of the European call and European put given by the binomial model satisfy the put-call parity relationship. Explain your answer.

**Questions.6 (5 Marks)**

Suppose the risk-free interest rate is 6% per annum with continuous compounding for all maturities, and the dividend of Rs. 10 per share on a stock is expected after two months. The current spot price of the stock is Rs. 5000.

1. What is the three-month theoretical futures price of the stock? Explain your answer.
2. Explain the arbitrage opportunities if the actual three-month futures price of the stock in the market is Rs. 5075. Show full working