

DSEF08 – Derivatives and Risk Management

Masters of Commerce
Semester IV
DSE – Elective Paper
Derivatives and Risk Management

Course Type/ Course Code	Course Title	Lectures	Tutorials	Practical	Credit	Pre-requisites
DSEF008	Derivatives and Risk Management	3	0	1	4	NIL

Objectives: The course aims to equip the students with the fundamentals of future and option pricing, advanced hedging strategies and risk assessment techniques. Learners will be able to develop the ability to price and hedge derivative positions, assess risk, and apply advanced strategies in derivatives trading.

Learning outcomes: After completion of the course, learners will be able to:

- Explain the structure and functioning of derivative markets, including exchange-traded and OTC instruments.
- Price and evaluate futures and options contracts using models such as the binomial model, the Black-Scholes model and Black model
- Apply hedging strategies using swaps, options, and futures. Design and implement option trading strategies for different market situations.
- Assess risk using Value at Risk (VaR) models and evaluate credit risk in derivatives transactions.

Contents:

Unit I (10 Hours)

Overview of Exchange-Traded and OTC Markets, Derivative Instruments: Forwards, Futures, Swaps, and Options, Market Participants: Hedgers, Speculators, and Arbitrageurs, Hedging Fundamentals: Concepts, cross-hedging, stock index futures, and stack-and-roll, Indian Derivatives Market Landscape.

Unit II (15 Hours)

Futures Pricing (Cost-of-Carry Model) for financial assets and commodities (including income and non-income paying assets, concept of convenience yield), convergence, basis risk, and calendar spreads; designing hedging, speculative and arbitrage strategies; manage exposure through roll yield strategies, asset allocation and portfolio strategy.

Option Pricing: Factors affecting option pricing, upper and lower bounds for option prices, Put-Call Parity: Arbitrage. Binomial Model: No-Arbitrage argument, One- and two-step

models, risk-neutral valuation, pricing European and American options, Black-Scholes Model: applications to stocks (with dividends), currencies, and futures, implied volatility, Black's model (1976). Greeks and Hedging: Delta, Gamma, Vega, Theta, Rho, strategies for Greek-neutral portfolios. Estimating volatility, exponentially weighted moving average model, GARCH(1,1) model.

Unit III **(10 Hours)**

Swaps: Interest Rate Swaps, Currency Swaps, Commodity Swaps, Equity Swaps, Credit Default Swaps (CDS), and Exotic Swaps including Amortizing, Accreting, Basis, Constant Maturity Swaps (CMS), and Swaptions. Hedging with Swaps: Portfolio hedging, dynamic hedging, cross-currency strategies. Options Strategies: spreads, straddle, strangle, iron condor, butterfly, covered calls, cash-secured puts, calendar spreads, protective puts, collars, ratio spreads, arbitrage strategies such as box spreads, conversions, reversals, and complex strategies such as iron butterfly, double diagonal, ratio spreads.

Unit IV **(10 Hours)**

Value at Risk (VaR): Historical simulation, variance-covariance (linear and quadratic models), Monte Carlo simulation, stress testing, back testing. Credit Risk: Credit ratings, default probabilities, recovery rates, estimation techniques using bond yield spreads and equity prices, credit risk in derivatives, credit VaR, and default correlation.

Practical Exercise: **(30 Hours)**

The students shall be required to:

- Use Black (1976) model for option pricing of Nifty index options and compute implied volatility using goal seek. Examine if the implied volatility constructed exhibits a volatility smile/ smirk. Also analyse if the assumption of constant volatility in Black and Scholes model holds.
- Extract historical put and call contracts for any three months. Divide these contracts according to their moneyness and build a delta neutral strategy. Compute daily returns using dynamic delta hedging strategy. Analyse if you are able to make normal profits from the derivative strategy.
- Design and implement option strategies such as straddle, strangle, and butterfly spreads based on different market scenarios—rising prices, falling prices, or stable prices. Select an underlying asset, identify appropriate strike prices and expiry dates, and record option premiums. Simulate the outcomes at expiry, calculate the net profit or loss for each strategy, and analyze whether the chosen strategy aligned with the market movement. Discuss if the strategy helped in generating profits or limiting losses, and reflect on potential improvements in strategy selection based on market conditions.
- Estimate Value at Risk (VaR) for a derivatives portfolio using historical simulation and variance-covariance methods.

Suggested Readings:

- Hull, John C. (2022). Options, Futures and Other Derivatives, 11e. Pearson Education.
- Chance, Don M. & Brooks, Robert (2015). Derivatives and Risk Management Basics. Cengage Learning.
- Kolb, Robert W. & Overdahl, James A. (2010). Financial Derivatives: Pricing and Risk Management. Wiley.
- Jarrow, Robert A. & Turnbull, Stuart M. (2000). Derivative Securities. South-Western College Publishing.
- Shreve, S. E. Stochastic Calculus for Finance I: The Binomial Asset Pricing Model. New York: Springer, 2005.
- Tuckman, Bruce & Serrat, Angel (2011). Fixed Income Securities: Tools for Today's Markets. Wiley.

Research Papers:

- Bakshi, G., C. Cao, and Z. Chen. "Empirical Performance of Alternative Option Pricing Models," Journal of Finance, 52, No. 5 (December 1997): 2004–49.
- Bharadwaj, A. and J. B. Wiggins. "Box Spread and Put–Call Parity Tests for the S&P Index LEAPS Markets," Journal of Derivatives, 8, 4 (Summer 2001): 62–71.
- Black, F. "Fact and Fantasy in the Use of Options and Corporate Liabilities," Financial Analysts Journal, 31 (July/August 1975): 36–41, 61–72.
- Black, F. "How We Came Up with the Option Pricing Formula," Journal of Portfolio Management, 15, 2 (1989): 4–8.
- F. Black and M. Scholes, "The Pricing of Options and Corporate Liabilities," Journal of Political Economy, 81 (May/June 1973): 637–59;
- French, K. R. "Stock Returns and the Weekend Effect." Journal of Financial Economics, 8 (March 1980): 55–69.
- Hull, J. C., and A. White. "Optimal Delta Hedging of Options," Journal of Banking and Finance, 82 (September, 2017): 180–190.
- R.C. Merton, "Theory of Rational Option Pricing," Bell Journal of Economics and Management Science, 4 (Spring 1973): 141–83.
- Reischach, D., and U. Wystup. "FX Volatility Smile Construction," Working Paper, Frankfurt School of Finance and Management, April 2010.

Note: Suggested readings will be updated by the Department of Commerce and uploaded on Department's website.