



**FIRST SEMESTER 2023-24**  
Course Handout Part II

Date: 11-08-2023

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : **FIN F414**  
Course Title : **FINANCIAL RISK ANALYTICS & MANAGEMENT**  
Instructor-in-Charge : **Thota Nagaraju** (nagaraju@hyderabad.bits-pilani.ac.in)

**Scope and Objective of the Course:**

**Textbooks:**

1. John C. Hull, Risk Management & Financial Institutions, 4th Edition, Wiley
2. Credit Suisse Material

**Reference books**

- 1) Phillippe Jorion (2007). Value at Risk, 3rd Edition: The New Benchmark for Managing Financial Risk John C Hull (2015). Options, Futures, and Other Derivatives, 9th Edition
- 2) Michel Crouhy (2014). The Essentials of Risk Management, 2nd Edition. John C Hull (2012). Risk Management and Financial institutions, 3rd Edition.
- 3) Advanced Engineering Mathematics by Erwin Kreyszig, 10th Edition
- 4) A First Course in Probability by Sheldon Ross
- 5) Introductory econometrics for finance" by Chris Brooks 2nd Edition
- 6) Basic Econometrics, Damodar Gujarati , Dawn Porter , and Sangeetha Gunasekar, 5<sup>th</sup> edition.

**Course Plan:**

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
<b>Module 1: Preparatory Sessions (9 Sessions)</b>	This module reviews the basic concepts of Limits and OLS, Continuity; Differentiation (Chain, Product and Quotient Rules), Integrals (Definite and Indefinite); Sequences and series; Partial derivatives; Measures of Central Tendencies and Dispersion; Skewness, Moments, Kurtosis; Random Variables (Discrete and continuous) Expectation and Joint Distribution; Discrete probability distributions (Binomial, Poisson and Multinomial), Normal Distribution; Ordinary Least Squares (Single & Multiple) & Maximum Likelihood Estimation; Relaxing OLS	Heteroscedasticity, Multicollinearity, Autocorrelation, AR, AM, ARIMA, GARCH, and VAR Models	<b>R5: Ch3, 4, 5, 6, 7, 8, 9</b> <b>R6: ch 5, 6 and 8</b>

	assumptions (Heteroskedasticity & Autocorrelation); Dummy and Qualitative Response Variable (Logit and Probit); AR, MA, ARIMA, VAR Models; ARCH, GARCH Models; pricing of Forwards, Futures and Options.		
<b>Module 2: Introduction to Complete and Efficient Markets</b> <b>No. of Sessions: 3</b>	Banks & Risk Management, Capital regulation of bank, Value creation through risk management, financial risk systems, In this module, we will begin with the introduction to efficient and complete markets, which is the precursor for pricing of financial instruments based on arbitrage and risk neutral pricing. We begin with a market on coin toss to demonstrate these concepts and drive home the theory of arbitrage through the Arrow-Debreu securities. We then move from coin tosses to actual financial instruments of forwards and options. We discuss the market efficiency and completeness to understand the no-arbitrage pricing and risk-neutral pricing.	No arbitrage pricing models	<b>R2, R3 and Credit Suisse Material (1.1)</b>
<b>Module 3: Overview Financial Markets and Asset Classes</b> <b>No. of Sessions: 6</b>	This module deals with different financial markets and their work to enable a better understanding of how the transactions are facilitated and also give a brief overview about different asset classes like equities and FX. We will start with different financial markets like capital markets which comprise of both Primary and Secondary markets, Money Market, Cash or Spot market, Derivatives markets and finally Forex and Interbank markets. We will also discuss about different asset classes, differences among asset classes and key features.	<b>Financial Markets and Asset Classes</b>	<b>TB, R2, R3 and Credit Suisse Material (2)</b>
<b>Module 4a: Options and Greeks</b> <b>No. of Sessions: 3</b>	In this module, we introduce a class of derivatives called Options and risk measures associated with these options called Greeks. We will start with definition and types of Options and then move on to discuss the basic strategies and payoffs. We will learn about different pricing theories for options like Binomial Option pricing and then discuss about the Greeks and how they are utilized in risk management practices. We then cover about the trading of Greeks before we conclude this module with brief overview of basic exotic options.  <b><u>Simulation</u></b>  "Normal random number generation; Evolution of spot using GBM; Finding the price of a bond; Duration hedging and sensitivity calculation; Option pricing using BSM, strike-price profile, option pricing using Monte-Carlo; Implied Volatility of an option; Implied Volatility vs Realized Volatility; Delta-	Options and Greeks	<b>TB, R2 &amp; R3)</b>  <b>Simulation Excel sheet will be shared</b>

	hedging options"		
<b>Module 4b: Forex Risk Management</b>	Forex Risk Management (Interest rate parity. PPP, Fundamental analysis; translation Economic exposure, transaction and hedging strategies.)	FX risk Mgmt	<b>(TB, R2 &amp; R3)</b>
<b>Module 5: Introduction to Risk (Market, Credit, Operation &amp; Enterprise) and Measures of Market Risk</b> <b>No. of Sessions: 3</b>	<p>This module starts with a brief introduction to Risk, and highlights various types of risks like market risk, credit risk, operational risk etc before going in detail of Market risk. We will also describe risk and return concepts, measurement of various risks. We will introduce the most widely used industry standard called Value at Risk (VaR). We will then dive into the details of types of VaR and compare them with alternate risk measures. We then move on to the basics of Historical Simulation model, underlying assumptions, various return calculation methods and functions to capture the market risk. We will conclude this module by learning about the Responsive VaR model, understanding the Exponential Weighting and Expected Shortfall approaches.</p> <p><b>Followed by simulation</b></p> <p>Creating a hypothetical portfolio (FX, IR and EQ) and running the simulations on their prices/yield in terms of Parametric VaR; Historical Simulation VaR and Monte Carlo VaR (1000 simulations)</p>	Value at Risk (VaR) Models	<b>(TB, R1, R2 &amp; R3)</b>  <b>Simulation Excel sheet will be shared</b>
<b>Module 6: Advanced VaR models</b> <b>No. of Sessions: 6</b>	<p>This module builds on from the VaR concepts introduced in the earlier model and addresses the shortcomings of the basic VaR model like the distributional assumptions. We then discuss about the gaps identified in VaR model in addressing the behaviour of market volatility called Volatility Clustering. We will introduce the remedial approaches like EWMA, GARCH to address these gaps and critically assess these methods from the practical and implementation perspective. We will conclude this module by studying about the Principal Component Analysis (PCA) which explains about the estimation of VaR when there are multiple risk factors that are highly correlated.</p>	Advanced Value at Risk (VaR) Models	<b>TB, R2 &amp; R3 and Credit Suisse Material (3.2)</b>
<b>Module 7: Credit Risk Modelling</b> <b>No. of Sessions: 3</b>	<p>In this module, we will introduce the concepts of Credit risk and its modelling. We cover the aspects like Credit Default risk, Counterparty credit risk and concentration risk before we move on to the various metrics to quantify credit risk like Probability of Default (PD)</p>	Probability of Default (PD) and Loss Given Default	<b>(TB, R2 &amp; R3)</b>

	<p>) and Loss Given Default (LGD). We finally close this module with a discussion on methods to mitigate credit risk such as risk based pricing, netting, collateral, covenants, diversification etc.</p> <p style="text-align: center;"><b>Simulation</b></p> <p>Creating a hypothetical client (for example credit card) and a bank. Compute the EAD and LGD of Client; Assume that (LGD). Bank goes for insurance and they calculate the EAD from bank's perspective; insurance company perspective; do these calculation with and without netting; Compute the PD and finally compute the RWA for insurance and bank</p>		<p style="text-align: center;"><b>Simulation Excel sheet will be shared</b></p>
<p><b>Module 8: Market Risk Regulatory Framework</b> <b>No. of Sessions: 3</b></p>	<p>This module gives the basic understanding of regulatory framework from the market risk perspective. We will begin with quantitative aspects of Basel II market risk framework; cover various capital components like Regulatory VaR, Stressed VaR and Incremental Risk Charge (IRC). We then discuss about different regulatory mandated processes like back testing and associated details like definition of Trading PL and its components and also regulatory notification and reporting exercises. We then finally close this module by having an understanding about Limit Setting, Monitoring, RWA computation and Risk Management VaR</p>	<p>Regulatory VaR, Stressed VaR and Incremental Risk Charge (IRC).</p>	<p style="text-align: center;"><b>TB, R2 &amp; R3 And Credit Suisse Material (3.2)</b></p>
<p><b>Module 9: FRTB &amp; CCAR &amp; ERC</b> <b>No. of Sessions: 3</b></p>	<p>In this module, we cover about the evolving regulatory landscape and the future of risk management with the introduction of new regulations known as FRTB and CCAR. Having discussed the existing framework in the earlier module, we will discuss the new regulations in detail and assess the scope and impact on the current framework and also the capital implications due to these regulations. Along with these external regulatory requirements, we will also briefly touch upon the internal capital measures like Economic Risk Capital (ERC) which will capture the exposures from the Economic perspective rather than from an accounting view.</p>	<p>FRTB, CCAR and Economic Risk Capital (ERC)</p>	<p style="text-align: center;"><b>TB, R2 &amp; R3 and Credit Suisse Material (7.2)</b></p>
<p><b>Module 10: Dynamic Hedging and CAPM (Portfolio Risk Management for Individuals)</b> <b>No. of Sessions: 3</b></p>	<p>In the final module, we will conclude the key learnings of the entire course and have a working session on risk management through dynamic hedging, understanding hedge ratios, costs, P&amp;L related risk management. The course will end with rounding of risk management for an individual by using concepts of creating efficient portfolios and maximizing risk return trade-off.</p>	<p><b>Dynamic Hedging and CAPM</b></p>	<p style="text-align: center;"><b>TB, R2 &amp; R3 and Credit Suisse Material (6 &amp; 7.2)</b></p>

Evaluation scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Quizzes	Ten minutes each quiz	15%	Will be announced three days prior on CMS	CB
Group Assignment		20%	Second week of November 2023	OB
Mid-semester Exam	1.5hour	30%	11/10 - 11.30 - 1.00PM	CB
Comprehensive Exam	3 Hour	35%	12/12 AN	CB

**\*Note: *No make-ups for the quizzes & Assignments.***

All quizzes & assignments will be counted for final grade calculation.

**Chamber Consultation Hour:** Wednesday & Thursday 4:00 PM to 5:00 PM.

Group Assignment details will be shared on CMS by first week of October 2023. Assignment submission date: November 2<sup>nd</sup> week (Soft copy should be sent to [nagaraju@hyderabad.bits-pilani.ac.in](mailto:nagaraju@hyderabad.bits-pilani.ac.in) Post due date submissions will not be considered for evaluation and the entire group will be awarded zero marks in this component. Only 20 percent of the plagiarism is allowed and thereafter for every 10 percent of additional plagiarism, one mark (or ten points) will be deducted.

**Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Instructor in Charge**  
**FIN F414**  
**INSTRUCTOR-IN-CHARGE**