Course Syllabus: Quantitative Risk Management (QRM)

Course Information

- **Course title:** Quantitative Risk Management (QRM)

- **Level:** Advanced undergraduate / postgraduate

- **Duration:** 15 weeks (13 teaching weeks + midterm + guest / presentations)

- **Instructor:** Pasin Marupanthorn, Ph.D., CQF

- **Contact:** quantfilab@gmail.com; Line ID: `oporkab`

- **Course repository (documents, code, assignments):** https://github.com/QuantFILab/QRM-NIDA

Course Description

This course provides a rigorous introduction to the principles and methods of quantitative risk management as applied in modern financial institutions. Emphasis is placed on the interpretation of risk measures, the statistical modeling of financial losses and dependencies, and the practical implementation of models in a reproducible manner. The weekly schedule follows the QRM Tutorial chapter sequence and covers: risk measurement and loss distributions; coherent risk measures (including Value-at-Risk and Expected Shortfall); empirical properties of returns and volatility; time-series modeling and forecasting; extreme value theory for tail risk (block maxima/GEV and peaks-over-threshold/GPD); multivariate dependence modeling (correlation limitations, elliptical models, copulas, and tail dependence); aggregate risk modeling via frequency–severity and Monte Carlo simulation; market risk measurement and model evaluation (stress testing and backtesting concepts); and credit risk fundamentals with portfolio loss modeling. The course concludes with a special guest lecture from industry addressing real-world model governance, validation practices, and regulatory expectations.

Learning Resources

- **Primary learning site (slides and supporting materials):** QRM Tutorial Slides

- **Exercises and practice problems:** QRM Tutorial Exercises / Exercise Book

- **Course repository (announcements, lecture notes, notebooks, datasets when applicable, and assignment templates):** QuantFILab/QRM-NIDA

- **Recommended textbook:** A. J. McNeil, R. Frey, and P. Embrechts, *Quantitative Risk Management: Concepts, Techniques and Tools*, 2nd ed., Princeton University Press.

Weekly Schedule (15 Weeks, aligned to QRM Tutorial Slides)

Format assumption: 2 lectures/week (+ computing sessions as announced).

Wk	Topics (lectures) & learning focus	Slides
1	Course introduction; risk in perspective; loss distributions; VaR versus ES; basic risk aggregation.	Ch. 1
2	Risk measures and axioms; coherence; subadditivity; capital allocation intuition; risk contributions.	Ch. 2
3	Empirical properties of financial data: heavy tails, skewness, kurtosis; stylized facts; dependence basics.	Ch. 3
4	Financial time series I: return modeling; AR/MA/ARMA concepts; diagnostics; forecasting fundamentals.	Ch. 4
5	Financial time series II: volatility clustering; ARCH/GARCH intuition; risk forecasting; backtesting concepts.	Ch. 4
6	Extreme value theory I: block maxima; GEV family; tail motivation; estimation principles.	Ch. 5
7	Extreme value theory II: POT/GPD; threshold selection; EVT-based VaR/ES; tail stress testing.	Ch. 5
8	Multivariate models: correlation pitfalls; elliptical models; dependence measures; simulation building blocks.	Ch. 6
9	Copulas I: Sklar's theorem; copula construction; Gaussian and t copulas; simulation methods.	Ch. 7
10	Copulas II: Archimedean copulas; tail dependence; model choice; goodness-of-fit considerations.	Ch. 7
11	Aggregate risk: frequency–severity modeling; compound distributions; Monte Carlo; quantiles; allocation intuition.	Ch. 8
12	Market risk: historical simulation, parametric, and Monte Carlo VaR; stress testing; backtesting overview.	Ch. 9
13	Credit risk fundamentals: PD, LGD, EAD; rating migration intuition; structural vs. reduced-form ideas; loss modeling.	Ch. 10
14	Portfolio credit risk: dependence and factor ideas; portfolio loss distribution; credit VaR/ES; sensitivity analysis.	Ch. 11
15	**Special guest from industry:** QRM in practice (model governance, VaR/ES usage, stress testing, model validation, regulatory expectations, and career Q&A). Course wrap-up; project presentations (or final examination, if scheduled).	Guest lecture

Assessment and Grading

Component	Weight
Midterm Exam	40%
Final Exam	40%
Coursework (Works)	20%