

FIN-416

**Interest rate and credit risk models**

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<b>Cursus</b>	<b>Sem.</b>	<b>Type</b>
Financial engineering minor	H	Opt.
Financial engineering	MA1, MA3	Obl.

Language of teaching	English
Credits	6
Session	Winter
Semester	Fall
Exam	Written
Workload	180h
Weeks	14
<b>Hours</b>	<b>5 weekly</b>
Courses	3 weekly
Exercises	2 weekly
<b>Number of positions</b>	

**Remark**

MA3 only

**Summary**

This course gives an introduction to the valuation of interest rate securities with and without credit risk, the management and hedging of bond portfolios and the valuation and usage of interest rate and credit derivatives.

**Content**

Topics include:

- Introduction to interest rate and credit markets
- Estimating the term structure
- Short rate models
- Heath-Jarrow-Morton (HJM) framework
- Forward measures
- Forwards and futures
- Structural credit risk models
- Reduced-form credit risk models
- Credit default swaps (CDS)

**Keywords**

interest rate risk, credit risk, term structure, bonds, interest rate swaps, caps and floors, short rate models, HJM models, bankruptcy, ratings, CDS, structural models, reduced-form models

**Learning Prerequisites****Required courses**

- Derivatives
- Econometrics
- Introduction to finance
- Stochastic calculus

**Learning Outcomes**

By the end of the course, the student must be able to:

- Describe the various notions of interest rates and related basic products
- Apply the basic tools duration and convexity for interest rate risk management
- Derive an estimated term structure from market data
- Reconstruct the implied volatility surface for caps, floors, and swaptions from market data
- Implement some basic stochastic interest rate models, including the Vasicek and CIR short rate models
- Apply the industry standard Black and Bachelier models for pricing and quoting caps, floors, and swaptions
- Differentiate between structural and reduced-form models
- Assess / Evaluate Credit Default Swaps (CDS)

### Transversal skills

- Use a work methodology appropriate to the task.

### Teaching methods

Lectures, exercises, homework

### Expected student activities

attendance at lectures, completing exercises

### Assessment methods

- 25% Homework assignments
- 75% Final examination

### Supervision

Office hours	No
Assistants	Yes
Forum	No

### Resources

#### Virtual desktop infrastructure (VDI)

No

### Bibliography

- L. Andersen and V. Piterbarg, Interest Rate Modeling, Atlantic Financial Press, 2010.  
 D. Brigo and F. Mercurio, Interest rate models: Theory and practice, 2nd Edition, Springer Verlag, New York, 2007.  
 D. Filipovic, Term-Structure Models, Springer Verlag, 2009.  
 D. Lando, Credit Risk Modeling: Theory and Applications, Princeton University Press, 2004.  
 A. McNeil, R. Frey, P. Embrechts, Quantitative Risk Management, Princeton University Press, 2015.

### Ressources en bibliothèque

- [Quantitative Risk Management / McNeil](#)
- [Interest Rate Modeling / Andersen](#)
- [Term-Structure Models / Filipovic](#)
- [Credit Risk Modeling: Theory and Applications / Lando](#)
- [Interest rate models: Theory and practice / Brigo](#)

