NATIONAL TAIWAN UNIVERSITY
Department of International Business
Financial Computation (金融計算)

Professor Jr-Yan Wang (王之彥) **Spring 2021**
Room 103, Building 2, College of Management **Thursday 9:10-12:10**
jryanwang@ntu.edu.tw **02-33664987**

COURSE DESCRIPTION

The discipline of **Financial Computation (金融計算)** or **Financial Engineering (財務工程)** combines four fields: **Finance (財務)**, **Computer Science (電腦)**, **Mathematics (數學)**, and **Statistics (統計)**. The major goal of this course is to learn how to solve pricing problems for various derivative contracts by developing **analytic formulae (解析解)** and/or **computer programs (電腦程式)**. Specifically, the pricing methods and their mathematical fundamentals for many exotic options will be introduced in this course, such as **Asian options (亞洲式選擇權)**, **barrier options (障礙選擇權)**, **lookback options (回顧選擇權)**, **convertible bonds (可轉換公司債)**, and **rainbow options (彩虹選擇權)**.

To ensure the fluency of my lecture, I assume that students are equipped with the basic knowledge of Finance, especially that about derivatives. It would be better that students already learned the courses of **"Futures and Options"** or other similar courses before. Extended from the basic knowledge, several topics will be sufficiently studied in this course, such as stochastic processes (隨機過程), option pricing models, various numerical techniques, hedging strategies for options/futures, etc.

The basic ability of computer programming is required for students to implement their homework. However, the time constraint does not allow me to teach computer programming in details, so students need to learn it by themselves. VBA is a highly recommended computer language for beginners. My website provides several PowerPoint, PDF, EXCEL VBA sample files to briefly introduced. **Do not worry about the lack of the computer programming skill.** According to my experience to teach this course for nearly 20 years, a high percentage of students in this course never wrote a computer program before, but less than 1% of students failed this course.

It is my hope that students can learn many financial theories, good programming practices, advanced mathematics, and most importantly, the true meaning of the financial engineering in this course.

LECTURE NOTES AND REFERENCES

Lecture Notes: http://homepage.ntu.edu.tw/~jryanwang/ → Course Information → Financial Computation or Financial Engineering (graduate level).

(DO NOT access CEIBA for the syllabus and lecture notes)

Lecture Video: The each-week lecture video will be posted on NTU COOL within 24 hours after the class dismissed. If not, please remind me via sending me an email.

References:

1. Options, Futures, and Other Derivatives, by John C. Hull, 10th ed., 2018.
2. Financial Engineering and Computation: Principles, Mathematics, Algorithms, by Yuh-Dauh Lyuu, 2002.
3. Derivatives: The Theory and Practice of Financial Engineering, by Paul Wilmott, 1998.
4. Monte Carlo Methods in Financial Engineering (Stochastic Modelling and Applied Probability), by Paul Glasserman, 2003.
5. Introduction to Stochastic Calculus with Applications, 3rd ed., by Fima C. Klebaner, 2012.
6. Financial Calculus: An Introduction to Derivative Pricing, by Martin Baxter and Andrew Rennie, 1996.
7. Numerical Recipes: The Art of Scientific Computing, 3rd ed., by William H. Press, Saul A. Teukolsky, William T. Vetterling, and Brian P. Flannery, 2007.
8. The Complete Guide to Option Pricing Formulas, by Espen G. Haug, 2nd ed., 2007.
9. 金融工程學：金融商品創新與選擇權理論，第三版，陳松男, 2008.
10. C++財務程式設計，戴天時, 2005.

HOMEWORK AND GRADING

Homework (5 computer programs)	92%
Extra bonuses (2-3 computer programs)	10-15%
Class participation	+2-3%

※ For each homework, the basic requirement is worth 80 points, and there are at most two bonuses worth additional 10-15 points.

※ In addition to these 5 pieces of homework, there are 2 or 3 extra bonuses, each of which is worth 5 additional points for your final scores in this course.

※ For each homework, there are two weeks available for students to accomplish it.

※ On the due date, the demonstration of your program will take place in the third hour of the lecture.

※ Every one-week delay of the demonstration will result in a deduction of 5 points from the score you earn.

※ It is highly encouraged to discuss the homework with classmates, but **DO NOT COPY** programs from others. The copying behavior (according to the judgement of the teaching assistant or me) will result in a 50% deduction from your score and the score of the classmate who allows you to copy his/her programs.

※ I will check attendance twice or three times in this semester. Each attendance result is worth 1 additional point for your final scores in this course.

RULES IN CLASS

※ **DO NOT DISTRACT other students** from listening to my lecture, e.g., do not chat with other students when I am talking.

※ If you have any questions during my lecture, feel free to interrupt me by raising your hand.

COURSE SCHEDULE

Week	Date	Topic	Reading
1	Feb. 25	Course overview VBA introduction	Syllabus and reference books
2	Mar. 4	Stochastic Process	Ch 1
3	Mar. 11	Stochastic Process	Ch 1
4	Mar. 18	Stochastic Process	Ch 1
5	Mar. 25	Black-Scholes Model	Ch 2
6	Apr. 1	**Holiday (Study Day)**	**No lecture**
7	Apr. 8	Black-Scholes Model*	Ch 2
8	Apr. 15	Overview of Options	Ch 3
9	Apr. 22	Binomial Tree Model*	Ch 4
10	Apr. 29	Binomial Tree Model†	Ch 4
11	May 6	Monte-Carlo Simulation* and Finite Difference Method	Ch 5

12	May 13	Monte-Carlo Simulation and Finite Difference Method†	Ch 5
13	May 20	Lookback Option*	Ch 9
14	May 27	Lookback Option	Ch 9
15	June 3	Asian Option*	Ch 10
16	June 10	Asian Option	Ch 10
17	June 17	Monte Carlo Simulation for American Options†	Ch 11
18	June 24	Monte Carlo Simulation for American Options	Ch 11

* Homework assignment supposed † Extra bonus assignment supposed

※ Note that the above schedule is an estimated version, I will dynamically adjust the speed of my lecture according to the feedback of students.

※ If time is enough, I will introduce non-constant volatility models (Ch 6), Greek letters of options (Ch 7), barrier options (Ch 8), or interest rate and credit models (Ch12).

OFFICE HOURS

Monday 15:10-16:30 and Thursday 15:10-16:30

Room 712, Building 2, College of Management

※ It is not suggested to ask academic or programming questions in emails. The face-to-face communication is the best way to make me understand your questions and give you the most appropriate instruction to solve your problems.

※ To maintain fairness in the class, the teaching assistant and I cannot help any student to debug his/her programs. Instead, the teaching assistant and I can explain the suggested algorithm or try to understand your algorithms and discuss it with you.

※ Try to fully utilize the office hours before making an individual appointment.

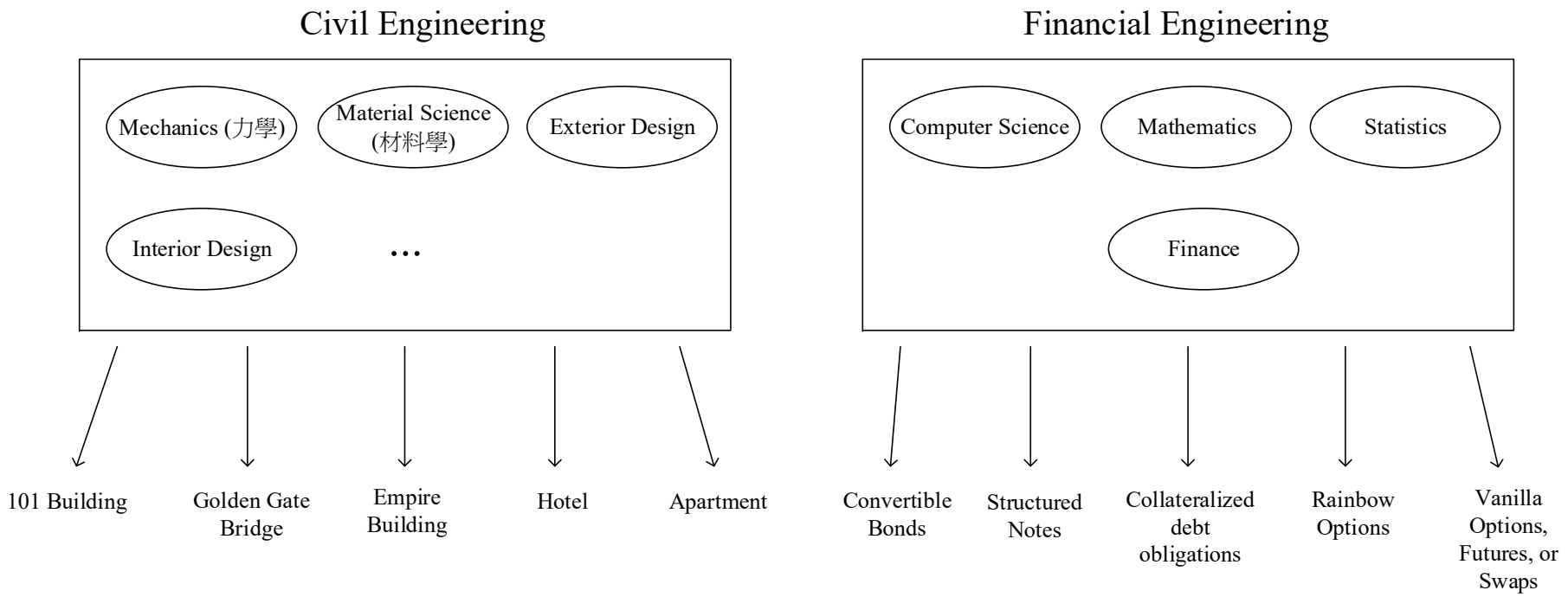
SPECIAL NOTE

※ For students in Graduate Institutes of International Business and Finance in College of Management who would like to ask me to be the advisor of their master or PhD theses, they need to pass this course first.

TEACHING ASSISTANT

XXX XXXXXXX@ntu.edu.tw

The reason for the term of “Financial Engineering”



※ Common business model: Produce or create products with least costs, and sell them with highest prices