Bachelor of Engineering Program in

Financial Engineering

(International Program)

(2019 New Program)

Faculty of Engineering

King Mongkut's Institute of Technology

Ladkrabang

Bachelor of Engineering Program in Financial Engineering

(International Program)

2019 New Program

Name of Institution	King Mongkut's Institute of Technology Ladkrabang (KMITL)
Faculty/Campus/College	Faculty of Engineering
Program Code	XXXXXX

Part 1 General Information

1. Program title

Title (Thai) : หลักสูตรวิศวกรรมศาสตรบัณฑิต สาขาวิชาวิศวกรรมการเงิน (หลักสูตรนานาชาติ)

Title (English) : Bachelor of Engineering Program in Financial Engineering (International Program)

2. Degree title

Full Title (Thai) : วิศวกรรมศาสตรบัณฑิต (วิศวกรรมการเงิน)

(English) : Bachelor of Engineering (Financial Engineering)

Abbreviation (Thai) : วศ.บ. (วิศวกรรมการเงิน)

(English) : B.Eng. (Financial Engineering)

3. Major or minor subjects (if any)

None

4. Total number of credits

Total number of credits no less than 143 CP

5. Program characteristics

5.1 Program type

4-year academic undergraduate program

Interdisciplinary program

5.2 Language of instruction

English

5.3 Admission

Both Thai and non-Thai students

5.4 Cooperation with other institutions

— The Faculty of Engineering, King Mongkut's Institute of Technology Ladkrabang (KMITL), cooperates with the School of Development Economics, National Institute of Development Administration (NIDA), in offering a combined Bachelor's and Master's program in Financial Engineering under the Memorandum of Agreement (MoA) between the two institutions.

- The combined Bachelor's and Master's program operated under the MoA consists of
    a) The Bachelor of Engineering Program in Financial Engineering (International Program) offered by KMITL (the program detailed in this TQF-2 document)
    b) The Master of Science Program in Financial Engineering (English Program) offered by NIDA (detailed in another TQF-2 document prepared by NIDA)
- A five-year study plan that enables students to graduate from both programs (and obtain one Bachelor's degree from KMITL and one Master's degree from NIDA) is provided. Under this five-year study plan, in the first four years of the study period, students register in the Bachelor of Engineering in Financial Engineering Program at KMITL and after satisfying all the requirements for graduation in this program (normally at the end of Year 4), they will be awarded the Bachelor of Engineering degree in Financial Engineering from KMITL. They will then enter into the Master of Science Program in Financial Engineering at NIDA and spend one more year (or longer if necessary) to complete the program and be awarded with the Master of Science degree in Financial Engineering from NIDA. Alternatively, after finishing the Bachelor's Program, students may choose not to enter the Master's program and thus obtain only the Bachelor's degree from KMITL.
- Both institutions are to collaborate in the teaching and management of programs at both the Bachelor's level and the Master's level.

5.5 Degree conferment

- One degree, Bachelor of Engineering in Financial Engineering, conferred by KMITL
- Graduates of the program may continue their study in the Master of Science in Financial Engineering Program at NIDA, as part of the combined Bachelor's and Master's program in Financial Engineering cooperated by KMITL and NIDA, and, after completing, be awarded with the Master of Science degree in Financial Engineering from NIDA.

6. Program status and approval

The program is expected to start in Semester 1/2019 (August 2019).
Deliberated and endorsed by the University Academic Committee in the …../…… meeting on ……..
Approved by the University Council in the …../…… meeting on ……..

7. Expected year that the program be published by the Commission of Higher Education

Academic Year 2021

8. Possible careers for the graduates

- Financial engineer
- Quantitative financial analyst
- Corporate finance officer
- Portfolio manager
- Analyst related to financial products, including credit risk, derivatives, etc.
- Financial regulator
- Lecturers, researchers, and experts in financial engineering or a related field
- Entrepreneur

2.8 Transfer of courses and credits and cross-university registration (if any)

These can be carried out according to the Regulation of King Mongkut's Institute of Technology Ladkrabang on Undergraduate Study B.E. 2559 (Appendix A) and the Proclamation of King Mongkut's Institute of Technology Ladkrabang on Cross-University Registration (Appendix B).

3. Curriculum and Lecturers

3.1 Curriculum

In order to successfully graduate from the program, the student must satisfy all of the requirements of the curriculum as set out below.

3.1.1 Total credit points

Total number of credits no less than 143 CP

3.1.2 Curriculum structure

Course Group	Required Credits	Credits in the Program
A. General Education Courses	≥ 30	30
A1. Gen-Ed Compulsory		21
A2. Gen-Ed Electives		9
B. Specific Courses	≥ 72	107
B1. Core Courses		24
B2. Major Compulsory Courses		77
B2.1 Projects and Seminars		8
B2.2 Computing Courses		24
B2.3 Economics and Finance Courses		33
B2.4 Financial Engineering Courses		12
B3. Major Electives		6
C. Free Electives	≥ 6	6
D. Field Experiences		0
Total	≥ 120	143

3.1.3 Courses

The list of the courses in each course group can be found below.

Meaning of the Digits in Course Code

The meaning of the 8-digit course code can be summarized as follows.

Digit No.	Meaning
1st, 2nd	Faculty/College offering the course: • 01 = Faculty of Engineering
3rd, 4th	Program to which the course belongs and place of instruction: • 00 = Common courses • 52 = Bachelor of Engineering Program in Financial Engineering (International Program)
5th	Course level: • 6 = Undergraduate
6th, 7th, 8th	For common courses (3rd and 4th digits = 00), these digits are running numbers.

	For courses specific to the program (3rd and 4th digits = 52), the 6th digit indicates course types as follows: • 0 = Projects and seminars • 1 = Computing courses • 2 = Economics and finance courses • 3 = Financial engineering courses • 4 = Major elective courses and the 7th and 8th digits are running numbers.

A. General Education Courses 30 CP

A1. General-Education Compulsory Courses 21 CP

Take all of the following courses:

Code	Title	Credit
01006510	Introduction to Economics	3 (3-0-6)
01006529	English for Business Studies	3 (3-0-6)
01006530	Technical Writing	3 (3-0-6)
01006531	Business Communication	3 (3-0-6)
01006532	Logic and Critical Thinking	3 (3-0-6)
01006813	Introduction to Programming	3 (2-2-5)
01006814	Business Computing	3 (2-2-5)

Students whose levels of English language proficiency are below a specified level will be required to take and pass the following ESL courses as audited courses:

Code	Title	Credit
01006500	Academic Listening and Speaking	4 (4-0-8)
01006501	Academic Reading and Writing	4 (4-0-8)

A2. General-Education Elective Courses 9 CP

Take at least 9 CP of the courses listed below:

Code	Title	Credit
01006502	Professional Ethics	3 (3-0-6)
01006503	Introduction to Psychology	3 (3-0-6)
01006504	Philosophy of Science	3 (3-0-6)
01006505	Creative Thinking	3 (3-0-6)
01006508	Digital Economy	3 (3-0-6)
01006509	Engineering and Public Policy	3 (3-0-6)
01006511	Thai Society and Culture	3 (3-0-6)
01006512	Asian Study	3 (3-0-6)
01006514	Innovative Communication	4 (4-0-8)
01006515	Design Methods for Innovations	4 (4-0-8)
01006516	Innovation Management	4 (4-0-8)
01006517	Lean Startup and Agile Business	4 (4-0-8)
01006518	Emerging Trends in Engineering	1 (1-0-2)
01006519	Introduction to Environmental Principles	3 (3-0-6)

Code	Title	Credit
01006520	Leadership and Personal Development	3 (3-0-6)
01006521	Meditation for Life Development	3 (3-0-6)
01006533	Bargaining and Negotiation	3 (3-0-6)

B. Specific Courses 113 CP

B1. Core Courses 24 CP

Take all of the following courses:

Code	Title	Credit
01006710	Introduction to Calculus	3 (3-0-6)
01006716	Linear Algebra	3 (3-0-6)
01006717	Differential Equations	3 (3-0-6)
01006718	Discrete Mathematics	3 (3-0-6)
01006719	Probability and Statistics 1	3 (3-0-6)
01006720	Probability and Statistics 2	3 (3-0-6)
01006721	Numerical Methods	3 (3-0-6)
01006722	Introduction to Stochastic Processes	3 (3-0-6)

B2. Major Compulsory Courses 77 CP

B2.1 Projects and Seminars 8 CP

Take all of the following courses:

Code	Title	Credits
01526001	Financial Engineering Project 1	3 (0-9-5)
01526002	Financial Engineering Project 2	3 (0-9-5)
01526003	Seminar 1	1 (0-3-0)
01526004	Seminar 2	1 (0-3-0)

B2.2 Computing Courses 24 CP

Take all of the following courses:

Code	Title	Credits
01526101	Object-Oriented Concepts and Programming	3 (2-2-5)
01526102	Data Structures and Algorithms	3 (2-2-5)
01526103	Optimization Methods	3 (3-0-6)
01526104	Information Systems and Databases	3 (3-0-6)
01526105	Introduction to Data Science	3 (2-2-5)
01526106	Computer Networking and the Internet	3 (3-0-6)
01526107	Machine Learning	3 (3-0-6)
01526108	Computer and Network Security	3 (3-0-6)

B2.3 Economics and Finance Courses 33 CP

Take all of the following courses:

Code	Title	Credits
01526201	Financial Reporting and Analysis	3 (3-0-6)
01526202	Microeconomics for Financial Analysis	3 (3-0-6)
01526203	Financial Management	3 (3-0-6)
01526204	Macroeconomics and Financial System	3 (3-0-6)

Code	Title	Credits
01526205	Introduction to Econometrics	3 (3-0-6)
01526206	Financial Markets and Institutions	3 (3-0-6)
01526207	Equity and Fixed Income Valuation	3 (3-0-6)
01526208	Portfolio Analysis and Management	3 (3-0-6)
01526209	Financial Derivatives	3 (3-0-6)
01526210	International Financial Markets	3 (3-0-6)
01526211	Financial Risk Management	3 (3-0-6)

B2.4 Financial Engineering Courses 12 CP

Take all of the following courses:

Code	Title	Credits
01526301	Ethics and Law for Financial Engineers	3 (3-0-6)
01526302	Financial Econometrics and Forecasting	3 (3-0-6)
01526303	Financial Technology	3 (3-0-6)
01526304	Financial Engineering	3 (3-0-6)

B3. Major Electives 6 CP

Take at least 6 CP of courses in the following list:

Code	Title	Credits
01526401	Topics in Financial Engineering	3 (3-0-6)
01526402	Topics in Financial Technology	3 (3-0-6)
01526403	Financial Communication and Presentation	3 (3-0-6)
01526404	Game Theory	3 (3-0-6)
01526405	Behavioral Finance	3 (3-0-6)
01526406	Market Microstructure and Algorithmic Trading	3 (3-0-6)
01526407	Big Data Analytics	3 (3-0-6)
01526408	Data Visualization	3 (3-0-6)
01526409	Computational Intelligence	3 (3-0-6)
01526410	Blockchain and Cryptocurrency Technologies	3 (3-0-6)
01526411	Financial Cybersecurity	3 (3-0-6)
01526412	Energy Economics and Finance	3 (3-0-6)
01526413	Stochastic Optimization	3 (3-0-6)
01526414	Advanced Numerical Methods in Finance	3 (3-0-6)
01526415	Quantitative Risk Management	3 (3-0-6)

C. Free Electives 6 CP

Take any undergraduate courses offered at KMITL totaling 6 CP as free electives.

D. Field-Experience Courses 0 CP

Take the following course:

Code	Title	Credits
01006805	Industrial Internship	0 (0-45-0)

3.1.4 Recommended study plan

Year 1 Semester 1

Code	Course Title	Credits
01006510	Introduction to Economics	3 (3-0-6)
01006529	English for Business Studies	3 (3-0-6)
01006532	Logic and Critical Thinking	3 (3-0-6)
01006710	Introduction to Calculus	3 (3-0-6)
01006716	Linear Algebra	3 (3-0-6)
01006813	Introduction to Programming	3 (2-2-5)
	Total	18

Year 1 Semester 2

Code	Course Title	Credits
01006530	Technical Writing	3 (3-0-6)
01006717	Differential Equations	3 (3-0-6)
01006718	Discrete Mathematics	3 (3-0-6)
01526101	Object-Oriented Concepts and Programming	3 (2-2-5)
01526201	Financial Reporting and Analysis	3 (3-0-6)
01526202	Microeconomics for Financial Analysis	3 (3-0-6)
	Total	18

Year 2 Semester 1

Code	Course Title	Credits
01006531	Business Communication	3 (3-0-6)
01006719	Probability and Statistics 1	3 (3-0-6)
01006721	Numerical Methods	3 (3-0-6)
01526102	Data Structures and Algorithms	3 (2-2-5)
01526203	Financial Management	3 (3-0-6)
01526204	Macroeconomics and Financial System	3 (3-0-6)
	Total	18

Year 2 Semester 2

Code	Course Title	Credits
010065__	General Education Elective 1	3 (X-X-X)
01006720	Probability and Statistics 2	3 (3-0-6)
01526103	Optimization Methods	3 (3-0-6)
01526104	Information Systems and Databases	3 (3-0-6)
01526205	Introduction to Econometrics	3 (3-0-6)
01526206	Financial Markets and Institutions	3 (3-0-6)
	Total	18

Year 3 Semester 1

Code	Course Title	Credits
01006722	Introduction to Stochastic Processes	3 (3-0-6)
01006814	Business Computing	3 (2-2-5)
01526105	Introduction to Data Science	3 (2-2-5)
01526106	Computer Networking and the Internet	3 (3-0-6)
01526207	Equity and Fixed Income Valuation	3 (3-0-6)
01526208	Portfolio Analysis and Management	3 (3-0-6)
	Total	18

Year 3 Semester 2

Code	Course Title	Credits
010065__	General Education Elective 2	3 (X-X-X)
01526107	Machine Learning	3 (3-0-6)
01526108	Computer and Network Security	3 (3-0-6)
01526209	Financial Derivatives	3 (3-0-6)
01526210	International Financial Markets	3 (3-0-6)
01526211	Financial Risk Management	3 (3-0-6)
	Total	18

Year 3 Summer Semester

Code	Course Title	Credits
01006805	Industry Internship	0 (0-45-0)
	Total	0

Year 4 Semester 1

Code	Course Title	Credits
010065__	General Education Elective 3	3 (X-X-X)
01526001	Financial Engineering Project 1	3 (0-9-5)
01526003	Seminar 1	1 (0-3-0)
01526301	Ethics and Law for Financial Engineers	3 (3-0-6)
01526302	Financial Econometrics and Forecasting	3 (3-0-6)
01526303	Financial Technology	3 (3-0-6)
015264__	Major Elective 1	3 (X-X-X)
	Total	19

Year 4 Semester 2

Code	Course Title	Credits
01526002	Financial Engineering Project 2	3 (0-9-5)
01526004	Seminar 2	1 (0-3-0)
01526304	Financial Engineering	3 (3-0-6)
015264__	Major Elective 2	3 (X-X-X)
____6___	Free Elective 1	3 (X-X-X)
____6___	Free Elective 2	3 (X-X-X)
	Total	16

Course Descriptions

01006500 Academic Listening and Speaking 3 (3-0-6)

Prerequisite: None

The course provides ESL students guidance and extensive practice in listening and speaking in academic and professional settings. Listening focuses on understanding spoken English in formats such as college lectures and news broadcasts. Note-taking tasks are also included to reinforce aural comprehension. Students learn to recognize organizational patterns. Students also practice outlining main ideas and supporting details through audio taped, videotaped and live resentations. Speaking focuses on increased fluency and communicative strategies used by native speakers in academic and professional settings.

01006502 Academic Reading and Writing 3 (3-0-6)

Prerequisite: None

This course is designed to improve the reading and writing skills of ESL students. Students receive practice on reading and vocabulary development. Reading practice will emphasize paraphrasing, summarizing, and the simple analysis of texts to identify main ideas and distinguish fact from opinion. Writing practice includes writing of simple and compound sentences, using compound tenses and correct word forms, word order, spelling, and punctuation. Students will also develop the ability to write varied, complex sentences and effective paragraphs in standard written English.

01006502 Professional Ethics 3 (3-0-6)

Prerequisite: None

This course introduces the theory and the practice of professional and engineering ethics, including code of conducts and regulations in academic, professional and technical fields. Students also learn about different approaches to ethical problems and examine real-life case studies, drawn from a variety of professional contexts. This course helps students develop skills and knowledge to manage and engage with ethical issues in their working lives.

01006503 Introduction to Psychology 3 (3-0-6)

Prerequisite: None

This course introduces a broad survey of psychological science including: sensation and perception; learning, memory, intelligence, language, and cognition; emotions and motivation; development, personality, health and illness, and social behavior. Students will study and discuss relations between the brain, behavior, and experience as well as learning the process of discovering new ideas and empirical results in the field.

01006504 Philosophy of Science 3 (3-0-6)

Prerequisite: None

The course provides a study of the thing we call “science”, together with its nature and methodology. The topics cover the meaning of science, reality, the nature of scientific observations, scientific theories and their discovery and formation, scientific explanations and predictions, the problem of induction, scientific rationality, the nature of scientific knowledge, concepts of truth, hypothesis testing, hypothesis confirmation, hypothesis falsification, logic of scientific method, and scientific progress.

01006505 Creative Thinking 3 (3-0-6)

Prerequisite: None

This course explores approaches to "How might we proceed when confronted by problems, situations too ambiguous, complex, or messy or impossible to be addressed directly through logical strategies?" It seeks to increase the participants' understanding of creativity, to improve their creative problem-solving skills and to enhance their ability to promote these skills in others, in a variety of educational settings. Students participate in activities designed to help develop their own creativity, and discuss the creative process from various theoretical perspectives. Readings are on such topics as creative individuals, environments that tend to enhance creative functioning, and related educational issues. Discussions with artists, scientists and others particularly involved in the creative process focus on their techniques, and on ways in which creativity can be nurtured.

01006508 Digital Economy 3 (3-0-6)

Prerequisite: None

This course will develop and utilize economic principles to better understand and explain the expansion and integration of information and communications technologies into the global economies. It will provide an introduction to concepts and theories useful in analyzing economic aspects of the digital and information technology revolutions.

01006509 Engineering and Public Policy 3 (3-0-6)

Prerequisite: None

This course examines the processes of public and private decision making which affects the evolution of a technology. While technology has an important role in shaping today's society, the social forces often plays a central role in the evolution of a technology. This course will study an engineering-related technology and its related policies. Students will discuss the technological and institutional issues, their interaction, the possible need for public policy and the factors that govern the policy.

01006510 Introduction to Economics 3 (3-0-6)

Prerequisite: None

This course gives an overview of economics, covering basic concepts and theories of microeconomics and macroeconomics. Topics in microeconomics studied include demand and supply, price elasticities, consumer behavior theory, production and cost theory, and perfect and imperfect competitions. Macroeconomics topics studied include aggregate demand and supply, macroeconomic data (e.g. gross domestic product, national income, etc.), management of economic growth, inflation problems, unemployment problems, money and banking systems, fiscal and monetary policy, taxation, international trades, and exchange rates.

01006511 Thai Society and Culture 3 (3-0-6)

Prerequisite: None

This course covers a study of Thai social identity and culture, development and inheritance of Thai culture, evolution of Thai society, as well as relation of Thai society and culture to societies and cultures of other countries.

01006512 Asian Study 3 (3-0-6)

Prerequisite: None

This course covers a study of an Asian country's language, social identity and culture. The course will discuss development and evolution of an Asian country, their economic prospect, cultural settings, societies and relations to the society and cultures of other countries.

01006514 Innovative Communication 4 (4-0-8)

Prerequisite: None

This course provides the study and practice of different communication skills including technical, professional and creative writing; infographics design; and delivering presentation. The students will study relevant techniques and learn to combine a range of skills in order to effectively communicating technical or specialized concepts. They will be able to explore and translate the benefit, the uniqueness, and the credibility of innovative ideas to a target audience.

01006515 Design Methods for Innovations 4 (4-0-8)

Prerequisite: None

This course consists of structural design process to create innovative products or services. The students will study the process to gather trends and information such as global direction, public opinions, technology, business, society and economic; learn how to extract context of interested area to find opportunities; study the processes used to gather behaviors, generate intense understanding about areas that lead to innovative concepts, produce innovative solutions and finally offering innovative products and services.

01006516 Innovation Management 4 (4-0-8)

Prerequisite: None

This course introduces students to the concepts of innovative thinking and innovation management practices. This course prepares students with the insights and instruction necessary to successfully lead worldwide enterprises or local ventures. Covered topics include organization, strategy planning, policy development, communities, research and development and product management. Students are exposed to issues that challenged real-world organizations. Students will learn best practices used by engineering leaders who successfully develop commercially viable products and services, create efficient operating processes, manage profitable organizations, and transform companies into industry leaders.

01006517 Lean Startup and Agile Business 4 (4-0-8)

Prerequisite: None

This course covers the basic principles of lean startup and agile business practice. Students will learn how to create an innovation accounting system to build products that meets customer demands; find the easiest and fastest ways to build minimum viable products to reduce time-to-market; learn tactics for improvement and measure customers' needs such as experimenting landing pages, A/B tests, MVPs on real customers; study how to implement an agile culture in business environments and learn how to develop business structures in order to keep the business functioning on constantly-moving units.

01006518 Emerging Trends in Engineering 1 (1-0-2)

Prerequisite: None

This course consists of a series of lectures given by different faculty members and distinguished speakers from the academic and industries. The lectures are designed to provide students a good understanding of each curriculum structure and the courses in each subject areas. Students will be introduced to emerging trends in Engineering and the relevance of our courses. New courses and research opportunities will be presented, including the faculty's research fields. The course also discusses basic learning and working ethics and prepares students career-making skills.

01006519 Introduction to Environmental Principles 3 (3-0-6)

Prerequisite: None

This course provides students general principles of environmental engineering and science. Basics of the physical processes involved in the interactions between water, soil, climate, and vegetation. Natural and human activity as it impacts the environment, weather and climate, pollution.

01006520 Leadership and Personal Development 3 (3-0-6)

Prerequisite: None

This course provides students fundamental skills for success in careers and team environments. The course will cover topics such as goal setting, career skills, leadership skills, teamwork, effective communication, and public speaking. Learning methods will consist of hands on activities and projects, group work, lecture, discussion, reading, writing, and presenting.

01006521 Meditation for Life Development 3 (3-0-6)

Prerequisite: None

This course introduces theory and practice of meditation including: meaning of meditation, objectives, methods, the beginning, process characteristics of reciting and meditating, benefits of meditation, meditation resistances and applying meditation in daily life, meditation as related to education and working purposes, objectives, methods, characteristics of the states of absorption (jhana) and insight knowledge (Nana), fundamental knowledge about insight meditation (Vipassana), differences between foundation meditation (Summata) and insight meditation (Vipassana), layout of foundation meditation (Summata) and insight meditation (Vipassana), insight mediation as related to world population.

01006529 English for Business Studies 3 (3-0-6)

Prerequisite: None

This course intends to train students studying in a business-related discipline, such as business, management, economics, accounting, and finance, their skills of academic English. Students learn skills in reading articles and listening to lectures or talks, writing essays, and discussing and giving presentations on business-related topics. Students will also learn useful vocabulary in business and economics.

01006530 Technical Writing 3 (3-0-6)

Prerequisite: None

This course provides a study and practice of academic writing skills in English language. By the end of the course, the students are expected to be able to compose clear and effective technical writings, including technical essays, reports, and articles, with correct and appropriate usage of the language.

01006531 Business Communication 3 (3-0-6)

Prerequisite: None

This course provides a study and practice of business communication and presentation skills in English language. The students are trained to communicate in business contexts through conversations and written correspondence (such as letters or emails) and learn how to effectively conduct a business meeting. The course will also study techniques in creating and delivering effective business presentations.

01006532 Logic and Critical Thinking 3 (3-0-6)

Prerequisite: None

This course intends to train students skills in analyzing and evaluating arguments, and in constructing good arguments. Students will be taught and trained to recognize arguments in real life, identify different modes of reasoning, including deduction and induction, notice common fallacies, and make use of symbolic logic, including propositional logic and predicate logic, and related logical tools and techniques for analyzing and evaluating arguments.

01006533 Bargaining and Negotiation 3 (3-0-6)

Prerequisite: None

This course studies the strategic, psychological, and cultural aspects of bargaining and negotiations, as well as practical techniques. Students in the class will learn and practice skills in effective bargaining and negotiation through role plays.

01006710 Introduction to Calculus 3 (3-0-6)

Prerequisite: None

Functions, limits, continuity and their applications, Mathematical induction, Introduction to derivative, Differentiation, Applications of derivative, Definite integrals, Antiderivative integration, Application of definite integral, Indeterminate forms, Improper integrals, Numerical integration, Sequences and series of numbers, Taylor series expansions of elementary functions

01006716 Linear Algebra 3 (3-0-6)

Prerequisite: None

Matrices and system of linear equations; Solving system of linear equations; Vector spaces and subspaces; Orthogonality; Determinants; Eigenvalues and Eigenvectors; Linear transformation

01006717 Differential Equations 3 (3-0-6)

Prerequisite: 01006710 Introduction to Calculus

Differential equations and their solutions; First-Order Differential Equations; Applications of First-Order Differential Equations; Explicit Method of Solving Higher-Order Linear Differential Equations; Applications of Second-Order Linear Differential Equations; Systems of Linear Equations

01006718 Discrete Mathematics 3 (3-0-6)

Prerequisite: None

Basic set theory, theory and techniques of counting, properties of integers, mathematical induction, recursive definitions, recurrent equations, sequences and summations, relations, graphs, and trees

01006719 Probability and Statistics 1 3 (3-0-6)

Prerequisite: None

Combinatorial analysis, axioms of probability, conditional probability and independence, random variables, discrete random variables and probability distributions, continuous random variables and probability distributions, joint probability distributions and random samples, point estimation, statistical interval based on a single sample

01006720 Probability and Statistics 2 3 (3-0-6)

Prerequisite: 01006719 Probability and Statistics 1

Test of hypotheses based on a single sample, inferences based on two samples, analysis of variance, multifactor analysis of variance, simple linear regression and correlation, nonlinear and multiple regression, goodness-of-fit tests and categorical data analysis

01006721 Numerical Methods 3 (3-0-6)

Prerequisite: 01006717 Differential Equations

Error analysis, methods of root findings, curve fitting, interpolation, Newton-Cotes integration formulas, integration of equations, numerical differentiation, Runge-Kutta methods, stiffness and multistep methods, boundary value and eigenvalue problem

01006722 Introduction to Stochastic Processes 3 (3-0-6)

Prerequisite: 01006717 Differential Equations AND
01006720 Probability and Statistics 2

Basic notions, Brownian motion and related topics, Bessel process, the Poisson process, properties of stochastic processes, stochastic integration, stochastic differentiation, stochastic integration techniques, stochastic differential equations, applications of Brownian motion, Martingales and Girsanov's theorem, examples of applications to Finance.

01006805 Industrial Internship 0 (0-45-0)

Prerequisite: None

Students taking this course are required to undertake a short-term industrial placement in a summer semester. This course allows students to put into practice in a real-world setting the knowledge and skills learned in class. At the end of the internships, students are expected to prepare and submit a report summarizing the work carried out during their internships.

01006813 Introduction to Programming 3 (2-2-5)

Prerequisite: None

This course is an introduction to computer programming using Python programming language. Topics covered include basics of structural programming, input and output, basics of object-oriented programming, basic data structures, exception handling, testing and debugging, and good coding style.

01006814 Business Computing 3 (2-2-5)

Prerequisite: None

The course provides basic understandings of computer systems in business and computer software for business tasks. Topics covered include basics of computer networking and the Internet, spreadsheet software, database management software, and the business-oriented utilization of the Internet.

01526001 Financial Engineering Project 1 3 (0-9-5)

Prerequisite: None

This course is the first half of the senior project. In this course, students are to work either individually or as a team under guidance of one (or more) advisors to study some financial engineering problem or design a financial innovation. The students are expected to do independent study on the topics that are necessary for or related to their project. The required project progress report must be submitted and presented to the examination committee at the end of the semester.

01526002 Financial Engineering Project 2 3 (0-9-5)

Prerequisite: 01526001 Financial Engineering Project 1

This course is the continuation of 01526001 Financial Engineering Project 1. At the end of this course, each team of student is required a submit a thesis and possibly the innovation developed during the project and present them to the examination committee at the end of the semester.

01526003 Seminar 1 1 (0-3-0)

Prerequisite: None

This course requires the students to attend seminars, lectures, and/or talks, given by invited speakers who are well-known in the industry or in research and development in areas related to financial engineering. The students are required to submit a written report summarizing what they have learned from each seminar.

01526004 Seminar 2 1 (0-3-0)

Prerequisite: None

This course requires the students to attend seminars, lectures, and/or talks, given by invited speakers who are well-known in the industry or in research and development in areas related to financial engineering. The students are required to submit a written report summarizing what they have learned from each seminar.

01526101 Object-Oriented Concepts and Programming 3 (2-2-5)

Prerequisite: None

This course introduces object-oriented concepts and methodology and studies object-oriented programming using C++. Topics covered include objects, classes, encapsulation, inheritance, multiple inheritance, polymorphism, abstract classes, static class members, object construction and destruction, namespaces, function overloading, function overriding, exception handling, template classes, and container classes. This course also covers basic techniques for testing and debugging object-oriented programs.

01526102 Data Structures and Algorithms 3 (2-2-5)

Prerequisite: 01526101 Object-Oriented Concepts and Programming

The course studies basic data structures and their related operations as well as an introduction to the analysis of algorithms. Topics include arrays, stacks, queues, lists, hash tables, trees, heaps, graphs, time and space complexity analysis of algorithms, asymptotic notations, iterative and recursive algorithms, and algorithms for sorting and searching and their complexity.

01526103 Optimization Methods 3 (3-0-6)

Prerequisite: 01006716 Linear Algebra

Basic operations research models and their applications are introduced. The course covers topics on linear programming, simplex method, duality and sensitivity analysis, transportation model, nonlinear programming, deterministic dynamic programming, deterministic inventory models, game theory, probabilistic dynamic programming, probabilistic inventory models, queuing models, and Markovian decision process.

01526104 Information Systems and Databases 3 (3-0-6)

Prerequisite: 01526102 Data Structures and Algorithms

This course studies basic concepts of information systems and database systems, with emphasis on the study of relational database systems. Topics include basic concepts of information systems and database systems, types of data models, relational database design, entity-relationship models, normal forms of relational databases, and database query languages. Some important non-relational data models are also introduced in this course.

01526105 Introduction to Data Science 3 (2-2-5)

Prerequisite: None

This course introduces an overview of data science and their applications on business. The topics to be studied include the extraction of information from data, an overview of important data analysis techniques, data visualization, software tools for data science, and case studies of real-world problem solving using data science.

01526106 Computer Networking and the Internet 3 (3-0-6)

Prerequisite: None

This course provides an overview of computer networks and communications and the Internet, covering the following topics: computer network reference models such as OSI and TCP/IP, basics of wired and wireless digital communications, concepts of peer-to-peer communications, standards and examples of network protocols, routing, quality of services, standards and

examples of transport protocols (such as TCP and UDP), network security, and computer network applications and services, such as emails, World Wide Web, and the voice and video communications over computer networks.

01526107 Machine Learning 3 (3-0-6)

Prerequisite: 01006716 Linear Algebra AND
01006720 Probability and Statistics 2

This course studies the principles and techniques of machine learning and introduces well-known algorithms for both supervised and unsupervised learning. The following topics are covered: basics of machine learning, software tools for machine learning, and the following machine learning techniques: kNN, Naïve Bayes, decision trees, regressions, neural networks, support vector machines, association rules, and k-means.

01526108 Computer and Network Security 3 (3-0-6)

Prerequisite: 01526106 Computer Networking and the Internet

This course provides a foundation of computer and network security. It covers security policy design, information classification and access control, security infrastructure design, software application security, network partitioning, risk analysis, virtual private networks, platform hardening, vulnerability assessment, basic cryptography (both symmetric key and asymmetric key), digital signature, authentication, personal identifier, certificate and key management. This course also emphasizes on mail security, IP security, web security, network intrusion, signatures of attacks, as well as intrusion detection and prevention using firewalls and other security software.

01526201 Financial Reporting and Analysis 3 (3-0-6)

Prerequisite: None

This course introduces accounting structure and financial reporting principles. It covers the analysis of financial information using financial ratios and other alternative methods to understand the firms' financial performance and position. It aims to foster learners' ability to use the financial information as an effective tool for the financial decision making.

01526202 Microeconomics for Financial Analysis 3 (3-0-6)

Prerequisite: None

This course applies microeconomic theories to analyse behavior of various economic agents and economic problems that arise in the economy. It discusses the ethical concepts in decision making process. It covers resource allocation through market mechanism, behaviors of consumers and producers, decisions under uncertainty, consumption involving time, production and its cost, pricing and non pricing strategies, and the impact of government policies on buyers' and sellers' behavior, and on the economic welfare.

01526203 Financial Management 3 (3-0-6)

Prerequisite: 01526201 Financial Reporting and Analysis

This course applies the modern corporate financial theory in making operating, financing, and investing decision. Capital structure, dividend policy, mergers and acquisitions, and other corporate activities related to financial decision making of the corporations are explored whether they are aligned with the target of the firm in maximizing shareholders' wealth and adhere to ethical standards, good governance, and corporate social responsibility.

01526204 Macroeconomics and Financial System 3 (3-0-6)

Prerequisite: None

This course provides the fundamental macroeconomics concepts and the structure of financial system. The objective is to equip students with a logical skill and ethical standards for the macroeconomic and financial analyses. Topics include

determination of income, the role of fiscal and monetary policy, inflation and unemployment, growth theory and business cycles, and lessons from past financial crises.

01526205 Introduction to Econometrics 3 (3-0-6)
Prerequisite: 01006719 Probability and Statistics 1
This course studies the tool for estimating behavior. The methodology includes regression analysis, hypothesis testing, and the models under the violation of classical assumptions. The basic econometric problems such as multicollinearity, autocorrelation and heteroscedasticity are included.

01526206 Financial Markets and Institutions 3 (3-0-6)
Prerequisite: None
This course offers an analysis of monetary theories and the financial system. It covers the importance of the financial system and institutions, the functions of money, behavior of interest rates, financial structure and asymmetric information, bank management and regulation. In addition, the targets and instruments of monetary policies, the transmission mechanism of monetary policy and its effectiveness, rational expectations and its applications will be critically analyzed.

01526207 Equity and Fixed Income Valuation 3 (3-0-6)
Prerequisite: 01526201 Financial Reporting and Analysis AND
01006719 Probability and Statistics 1
This course explores asset valuation theory and the applications to real world valuation cases. It also provides decision-making tools under uncertainty and risk, including standard asset pricing models used to determine financial asset prices, particularly equity and debt securities. Valuation techniques such as discounted cash flows and market based approach are included.

01526208 Portfolio Analysis and Management 3 (3-0-6)
Prerequisite: None
This course provides the principle asset allocation, modern portfolio theory, diversification, portfolio construction models. An analysis and management of securities risks, including portfolio management evaluation techniques will be examined.

01526209 Financial Derivatives 3 (3-0-6)
Prerequisite: 01526207 Equity and Fixed Income Valuation
This course introduces fundamental concepts of derivative pricing and hedging strategy, applying to a variety of underlying assets such as commodity, interest rate, currency and equity. Several financial derivatives will be examined including forwards, futures, swaps, options and credit derivatives.

01526210 International Financial Markets 3 (3-0-6)
Prerequisite: 01526204 Macroeconomics and Financial System OR
01526206 Financial Markets and Institutions
This course covers the international monetary system and balance of payments, the foreign exchange market, international capital markets and institutions, management of foreign exchange and political risks, and recent developments in international capital markets and the world economy.

01526211 Financial Risk Management 3 (3-0-6)
Prerequisite: 01526203 Financial Management

This course studies financial risk including market risk, credit risk, foreign exchange risk, and operational risk. It explores definition of risk, sources of risk, risk analysis, risk management process as well as risk evaluation and risk management strategies.

01526301 Ethics and Law for Financial Engineers 3 (3-0-6)

Prerequisite: None

This course provides a study of social, legal and moral issues that financial engineers should be aware of. An overview of the laws that are related to business and finance is studied. The course also trains the students to analyze the impact of financial engineering practice (as well as malpractice) on the economy and the society. Examples of real-world cases are studied in the course.

01526302 Financial Econometrics and Forecasting 3 (3-0-6)

Prerequisite: 01526205 Introduction to Econometrics

This course applies econometric techniques for empirical investigation in economics and finance. It reviews regression analysis, hypothesis testing, and the models under the violation of classical assumptions. Tools in analyzing the financial data are also introduced, i.e. dummy variable, discrete choice model Logit, Probit and panel data models. This course applies the time series econometric model to forecast the economic and financial data. The contents include long-run relationship and short-run response.

01526303 Financial Technology 3 (3-0-6)

Prerequisite: None

This course studies the major areas of financial technology, including current scope and applications of financial technology, technologies for financial transactions, digital finance and alternative finance, cryptocurrencies, regulations related to financial technology, data and security, and the future of finance, which is driven by data and cutting-edge technologies, such as blockchains, artificial intelligence, and big data.

01526304 Financial Engineering 3 (3-0-6)

Prerequisite: 01526209 Financial Derivatives AND
01526211 Financial Risk Management

This course aims to equip students with the understanding of financial innovations including topics such as product development and its process, recent financial instruments in both money and capital markets. More specifically, a critical analysis of its role in raising capital, investments, and risk management will be examined.

01526401 Topics in Financial Engineering 3 (3-0-6)

Prerequisite: None

Selected topics of current interest in financial engineering

01526402 Topics in Financial Technology 3 (3-0-6)

Prerequisite: None

Selected topics of current interest in financial technology

01526403 Financial Communication and Presentation 3 (3-0-6)

Prerequisite: None

This course aims to master the skills to interpret and communicate financial information in a way that provides key insights to activities related to financial engineering. It focuses on the way to convert financial data to provide meaningful business insights by integrating financial data and the use of software to make financial presentations with impact.

01526404 Game Theory 3 (3-0-6)

Prerequisite: 01006716 Linear Algebra

This course is an introductory course in non-cooperative game theory. Topics include equilibrium concept in static and dynamic game with complete and incomplete information. Applications in economics and finance will also be discussed.

01526405 Behavioral Finance 3 (3-0-6)

Prerequisite: None

This course covers the influence of psychology on the investors' behavior. It enables students to learn about the wide range of decision-making biases and information processing errors that influence financial decision making. It demonstrates how behavioral finance explain market activity and the behavior of investors. The course also explores the role of financial engineering tools to uncover investors' behavior and implications to trading strategies.

01526406 Market Microstructure and Algorithmic Trading 3 (3-0-6)

Prerequisite: 01526207 Equity and Fixed Income Valuation

This course covers the fundamental knowledge of market microstructure and discusses frameworks for analyzing bid-ask spread of the securities, liquidity, transaction costs, and trading strategies. It also covers algorithmic and high frequency trading, optimal order execution, execution quality analysis, dynamic limit order markets to enhance efficiency in tradings.

01526407 Big Data Analytics 3 (3-0-6)

Prerequisite: None

The course provides an overview of the techniques and tools for working with big data, as well as problems and possible solutions. Covered in this course include the following topics: sources, types and characteristics of the big data that are presently in use, data capturing, storage, processing, retrieval, analysis, and reporting and visualization. The students will also learn to develop computer programs that work with big data and utilize software tools or libraries for processing or analyzing big data.

01526408 Data Visualization 3 (3-0-6)

Prerequisite: None

This course studies principles and techniques for creating effective visualizations of data. The topics covered include principles of data visualization, basics of human visual perception and cognition, software tools for data visualization, graphs and charts, visualization of different kinds of data, basic image processing techniques, infographics, and information art.

01526409 Computational Intelligence 3 (3-0-6)

Prerequisite: 01006716 Linear Algebra

This course studies principles, theories, and techniques of computational intelligence. The course covers the following topics: evolutionary computing, fuzzy logic, and nature-inspired algorithms, including neural networks, swarm intelligence, and ant colony optimization.

01526410 Blockchain and Cryptocurrency Technologies 3 (3-0-6)

Prerequisite: 01526106 Computer Networking and the Internet

The course will provide students with an understanding of the concepts, the underlying technologies and mechanisms, and the applications of blockchains. Topics to be studied include the concept of distributed ledgers, an introduction to public-key cryptography and cryptographic hashing, how blockchains work, cryptocurrencies (such as bitcoins), and possible applications of blockchains, such as smart contracts, micropayments, and distributed storage.

01526411 Financial Cybersecurity 3 (3-0-6)

Prerequisite: 01526106 Computer Networking and the Internet

The course intends to provide students with an understanding of fundamental concepts and principles of cybersecurity, relevant technologies, and the important issues and considerations in cybersecurity in the financial sector. Topics studied include an introduction to computer networking and IT architectures in the financial sector; cyberattacks in the financial sector; malware; information security in the financial sector; cybersecurity software; cybersecurity laws; and policy and strategy for cybersecurity in the financial sector.

01526412 Energy Economics and Finance 3 (3-0-6)

Prerequisite: 01006510 Introduction to Economics OR
01526202 Microeconomics for Financial Analysis

This course aims to provide students with the knowledge and understanding of how energy markets work, as well as knowledge of how to analyze them and how they interact with the rest of the economy. A further aim is to give students advanced tools to analyze how energy and environmental policies affect the demand and supply of different types of energy. The course will address a number of different types of issues related to demand and supply of energy.

01526413 Stochastic Optimization 3 (3-0-6)

Prerequisite: 01006722 Introduction to Stochastic Processes

Stochastic Optimization provides an introduction to state-of-the-art quantitative modelling and solution methods for problems of decision-making under uncertainty. The topics cover Decision Analysis and Decision Trees, introduction to Stochastic Dynamic Programming including specific classes of Stochastic Dynamic Programs, such as sequential sampling problems and bandit problems, foundations and properties of Markov Chains, foundations and applications of Markov Decision Problems.

01526414 Advanced Numerical Methods in Finance 3 (3-0-6)

Prerequisite: 01006719 Probability and Statistics 1 AND
01006721 Numerical Methods

The use of mathematical models and numerical techniques is a practice employed by a growing number of applied mathematicians working on applications in finance. The topics cover, financial theory, basics of numerical analysis, numerical integration both deterministic and Monte Carlo methods, finite difference methods for partial differential equations, convex optimization, option pricing by binomial and trinomial lattices, option pricing by Monte Carlo methods, option pricing by finite difference methods, dynamic programming.

01526414 Quantitative Risk Management 3 (3-0-6)

Prerequisite: 01006719 Probability and Statistics 1 AND
01526211 Financial Risk Management

The course provides coverage of important topics in modern Quantitative Finance and Risk Management including Efficient Market Hypothesis, financial markets micro-structure and types of arbitrage, general principles of modelling the price dynamics of financial assets, market risk and other types of financial risks, Value-at-Risk (VaR) approach and applications, modelling of extreme market events, VaR analysis for financial derivatives using the Kolmogorov equations framework,

foundations of the copula methods, modelling of periodic and quasi-periodic trends in time series in connection with technical analysis, and the foundations of high-frequency arbitrage trading.