2023

Module description Catalog Program in Mathematics

FALCUTY OF MATHEMATICS AND COMPUTER SCIENCE

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Module description Catalog Program in Mathematics

1. General Education

1. Marxist-Leninist Philosophy - BAA00101

Module designation	Marxist-Leninist Philosophy
Semester(s) in which the module is taught	1st semester
Person responsible for the module	Lecturers at School of Political and Administration Sciences, VNU-HCM
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Do lecturing, teamwork, divide students into groups to solve problems
Workload (incl. contact hours, self-study hours)	135 Hours Contact hours: Lectures: 45 hours (in class) Private study: 90 hours (self-study)
Credit points	3 credits/ 4.5 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	The course equips students with the basic contents of the worldview and the Marxist-Leninist philosophical methodology. Helping students apply knowledge about the worldview, Marxist-Leninist philosophy, and philosophy creatively in cognitive and practical activities, to solve problems that the social life of a country or of the time being set.
Content	Marxist-Leninist philosophy is a course in the Marxist-Leninist knowledge block and Ho Chi Minh Thought. This module equips students with basic, general, and systematic knowledge of the problems of Marxist-Leninist philosophy. From there, learners have a basis and reasonable research and learning methods and apply them to the process of evaluating life phenomena.
Examination forms	Class discussion; Group presentations and reports; Mid-term exam: essay (opened-book); Final exam: essay (closed-book)

Study and examination requirements	1. Regulations for group presentations
	- Forming a group: 5 students/group. The deadline for group topic registration on the forum is session 2 or directly submit it to the lecturer at the exam. - Week 4 (4th session) begin to present in order. Note that the presenting groups need to fully show up and bring along all relevant documents. - Submission form: submit files and minutes of group work via email to the lecturer 2. Regulations on time, attendance and discipline in the course: attend class on time and at least 80% of the sessions (only to be absent for a maximum of 20%). Exam ban is applied to those who miss more than the regulated number of sessions. Students must have all test scores, lively discussions, constructive and serious statements in class.
Reading list	1. Textbook of basic principles of Marxism-Leninism, National Political Publishing House of Vietnam. 2. Textbook of Marxist-Leninist Philosophy, National Political Publishing House of Vietnam.

2. Marxist-Leninist Political Economy - BAA00102

Module designation	Marxist-Leninist Political Economy
Semester(s) in which the module is taught	1st semester
Person responsible for the module	Lecturers at School of Political and Administration Sciences, VNU-HCM
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Do lecturing, teamwork, divide students into groups to solve problems
Workload (incl. contact hours, self-study hours)	90 Hours Contact hours: Lectures = 30 hour (in class) Private study: 60 hours (self-study)

Credit points	2 credits/ 3 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Firstly, equip students with basic and core knowledge of Marxist-Leninist political economy in the context of economic development of the country and the world today. Ensure the basic, systematic, scientific, update new knowledge, associate with practice, creativity, skills, thinking, learner quality, connectivity to overcome duplication, enhance integration and reduce the load, reduce content that is no longer relevant or scholastic content for students of non-theoretical colleges and universities. Second, on that basis, forming thinking and analytical skills, assessing and identifying the nature of economic benefit relations in the country's socio-economic development, contributing to helping students build appropriate social responsibility in the job position and life after graduation. Third, contribute to building the stance and ideology of Marxism-Leninism towards students.
Content	The program content consists of six chapters: in which chapter one discusses the objects, research methods, and functions of the Marxist-Leninist Political Economy. Chapters 2 to 6 present the core content of the Marxist-Leninist political economy according to the subject's objectives. Specifically, issues such as goods, markets and the role of actors in the market economy; Producing surplus value in a market economy; Competition and monopoly in the market economy; Socialist-oriented market economy and economic interest relations in Vietnam;
	Industrialization, modernization, and international economic integration in Vietnam.
Examination forms	Class discussion; Group presentations and reports; Mid-term exam: essay (opened-book); Final exam: essay (closed-book)

Study and examination requirements	1. Regulations for group presentations - Forming a group: 5 students/group. The deadline for group topic registration on the forum is session 2 or directly submit it to the lecturer at the exam. - Week 4 (4th session) begin to present in order. Note that the presenting groups need to fully show up and bring along all relevant documents. - Submission form: submit files and minutes of group work via email to the lecturer 2. Regulations on time, attendance, and discipline in the course: attend class on time and at least 80% of the sessions (only to be absent for a maximum of 20%). Exam ban is applied to those who miss more than the regulated number of sessions. Students must have all test scores, lively discussions, constructive and serious statements in class.
Reading list	Mac-Leninist political economy textbook for undergraduates who are not majoring in political economy.

3. Scientific Socialism - BAA00103

Module designation	Scientific Socialism
Code, if applicable	BAA00103
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	Lecturers at School of Political and Administration Sciences, VNU-HCM
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	lecture, lesson, teamwork, divide students into groups to solve problems
Workload (incl. contact hours, self-study hours)	90 Hours Contact hours: Lectures = 30 hour (in class) Private study: 60 hours (self-study)
Credit points	2 credits/ 3 ETCS
Required and recommended prerequisites for joining the module	None

Module objectives/intended learning outcomes	The subject equips students with the basic contents of scientific socialism (one of the three components constituting Marxism-Leninism). Helping students apply basic knowledge of scientific socialism creatively in cognitive and practical activities, solving problems that the social life of a country, of the times being set.
Content	The subject equips students with the basic contents of scientific socialism (one of the three components constituting Marxism-Leninism). Helping students apply basic knowledge of scientific socialism creatively in cognitive and practical activities, solving problems that the social life of a country, of the times being set.
Examination forms	Class discussion; Group presentations and reports; Practices; Mid-term exam; Final exam
Study and examination requirements	1. Regulations for group presentations - Forming a group: 5 students/group. The deadline for group topic registration on the forum is session 2 or directly submit it to the lecturer at the exam. - Week 4 (4th session) begin to present in order. Note that the presenting groups need to fully show up and bring along all relevant documents. - Submission form: submit files and minutes of group work via email to the lecturer. 2. Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures)
Reading list	1. Textbook of Scientific Socialism, National Political Publishing House of Vietnam.
	2. The Basic Principles of Marxism-Leninism, National Political Publishing House of Vietnam.

4. History of Vietnamese Communist Party - BAA00104

Module designation	History of Vietnamese Communist Party
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	Lecturers at School of Political and Administration Sciences, VNU-HCM
Language	Vietnamese

Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, teamwork, divide students into groups to solve problems
Workload (incl. contact hours, self-study hours)	90 Hours Contact hours: Lectures = 30 hour (in class) Private study: 60 hours (self-study)
Credit points	2 credits/ 3 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	In terms of content: providing systematic and basic knowledge about the birth of the Communist Party of Vietnam (1920-1930), the Party's leadership over the Vietnamese revolution during the period of political struggle. government authority (1930-1945), in two resistance wars against French colonialism and American imperialism (1945-1975), in the cause of national construction and defense during the country's transition to socialism. association, conducting the renovation work (1975-2018). Ideologically: Through historical events and experiences on the leadership of the Party to build a sense of respect for objective truths, raise pride and confidence in the Party's leadership cause. About skills: Equipping with scientific thinking methods on history, skills in choosing research materials, studying subjects and the ability to apply historical awareness to practical work, criticizing misconceptions on the history of the Party.
Content	The course provides systematic and fundamental knowledge about the birth of the Communist Party of Vietnam (19201930), the Party's leadership for the Vietnamese revolution during the period of struggle for power (1930-1945), during the two resistance wars against the French colonialists and the American imperialists (1945-1975), in the cause of national construction and defense during the period of the whole country's transition to socialism, conducted doi moi (1975-2018). Through historical events and experiences in the leadership of the Party to build a sense of respect for objective truth, heighten pride and confidence in the Party's

	leadership cause. Equip with scientific thinking methods on history, skills in choosing research materials, studying subjects, and the ability to apply historical awareness to practical work, and criticize misconceptions about the history of the Party.
Examination forms	Class discussion; Group presentations and reports; Mid-term exam; Final exam
Study and examination requirements	1. Regulations for group presentations - Forming a group: 5 students/group. The deadline for group topic registration on the forum is session 2 or directly submit it to the lecturer at the exam. - Week 4 (4th session) begin to present in order. Note that the presenting groups need to fully show up and bring along all relevant documents. - Submission form: submit files and minutes of group work via email to the lecturer 2. Regulations on time, attendance and discipline in the course: attend class on time and at least 80% of the sessions (only to be absent for a maximum of 20%). Exam ban is applied to those who miss more than the regulated number of sessions. Students must have all test scores, lively discussions, constructive and serious statements in class.
Reading list	Curriculum of the History of the Communist Party of Vietnam, Issued by the Ministry of Education and Training.

5. HoChiMinh's Ideology - BAA00003

Module designation	HoChiMinh's Ideology
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	Lecturers at School of Political and Administration Sciences, VNU-HCM
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, teamwork, divide students into groups to solve problems
Workload (incl. contact hours, self-study hours)	90 Hours Contact hours: Lectures = 30 hour (in class) Private study: 60 hours (self-study)
Credit points	2 credits/ 3 ETCS

Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	About knowledge: Equip students with basic knowledge about the concept, origin, the process of formation and development of Ho Chi Minh thought; the basic contents of Ho Chi Minh's thought; the application of the Communist Party of Vietnam in the national-democratic revolution and the socialist revolution, in the current national renewal process. About skills: Helping students to think, analyze, evaluate, and creatively apply Ho Chi Minh's Thoughts to solve problems in real life, study, and work. About attitudes: Helping students improve their political bravery, patriotism, loyalty to the goal, the ideal of national independence associated with socialism; aware of the role and value of Ho Chi Minh's thought for the Vietnamese Party and nation; realize their responsibility in studying and training to contribute to the construction and defense of the country.
Content	Description of course content: the subject equips students with basic knowledge about objects, research methods, and learning meanings of Ho Chi Minh's ideology; on the basis, of the process of formation and development of Ho Chi Minh thought; on national independence and socialism; on the Communist Party and the State of Vietnam; on great national and international solidarity; about culture, ethics, people.
Examination forms	Class discussion; Group presentations and reports; Mid-term exam: Multiple choice (closed-book) or essay (openedbook); Final exam: Essay (opened-book)
Study and examination requirements	1. Regulations for group presentations - Forming a group: 5 students/group. The deadline for group

	topic registration on the forum is session 2 or directly submit it to the lecturer at the exam. - Week 4 (4th session) begin to present in order. Note that the presenting groups need to fully show up and bring along all relevant documents. - Submission form: submit files and minutes of group work via email to the lecturer 2. Regulations on time, attendance, and discipline in the course: attend class on time and at least 80% of the sessions (only to be absent for a maximum of 20%). Exam ban is applied to those who miss more than the regulated number of sessions. Students must have all test scores, lively discussions, constructive and serious statements in class.
Reading list	1. Textbook of Ho Chi Minh's Thoughts, National Political Publishing House of Vietnam 2. Study Guide for Ho Chi Minh's Thoughts, Ho Chi Minh City National University Publishing House

6. General law - BAA00004

Module designation	**General law - BAA00004**
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	Lecturers at School of Political and Administration Sciences, VNU-HCM
Language	Vietnamese
Relation to curriculum	General
Teaching methods	Lectures, seminars
Workload (incl. contact hours, self-study hours)	Total workload: 135 hrs Contact hours (lectures): 45 hrs Private study including examination preparation, specified in hours: 90 hrs
Credit points	3 (4.5 ECTS)
Required and recommended prerequisites for joining the module	None

Module objectives/intended learning outcomes	After completing the course, students will be able to: • General Objective: Understand the basic legal concepts and terms related to the country's legal system and state apparatus; apply legal provisions to solve some simple case studies; help students form and develop some skills such as looking up legal documents, analyzing legal regulations, and working in groups, thereby improving their sense of survival, learning and working following the Constitution and regulations. The law, the right behavior orientation in life. • Specific objectives/course output standards: + Knowledge: Present basic legal concepts and terms related to the state apparatus and the Vietnamese legal system; Solve some exercise cases based on the provisions of a law book in the legal system of Vietnam. + Skills: Analyzing legal regulations; Lookup legal documents; Working group. + Attitude, diligence: Raise awareness of living, studying, and working following the Constitution and the law.
Content	The module provides knowledge about the structure of the State apparatus as well as the functions, authority, and legal status of agencies in the State apparatus of the Socialist Republic of Vietnam in terms of economic management, Legal nature, and structure of the system of legal documents. From an overview of the system of legal branches in our State's legal system, a course is devoted to studying the basic contents of administrative law, civil law, and criminal law as
	branches of law. the main law (original branches of law) of the legal system, so that learners can easily access themselves to other branches of law arising from these major branches of law.
Examination forms	Written exam, Multiple choices, Oral presentation
Study and examination requirements	Minimum attendance at lectures is 80% Final score is greater or equal to 5.0/10.0
Reading list	1. General Law texbook, Ho Chi Minh City University of Law 2. Textbook of Theory of State and Law, Hanoi University of Law

7. Basic Economics - BAA00005

Module designation	Basic Economics
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	MSc. LE Nhan My,
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 90 hours. Contact hours (lecture): 30 hours. Private study including examination preparation, specified in hours: 60 hours.
Credit points	2 credits / 3 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Knowledge: • Forming and developing (one step) capacity to collect information, skills to synthesize and systematize issues in an overall relationship; skills to compare, analyze, comment, and evaluate micro-economic issues. • Grasp the basic content of Microeconomics - a part of economics. • Specifically: o Understand the theory of economic choice, the influence of the law of scarcity, and economic models on economic choice. o Understand the theory of supply and demand. o Understand the theory of consumer behavior. o Understand the theory of producer behavior. o Understand the theory of competition and monopoly. o Understand the theory of factor markets. o Understand the theory of the role of government. o Understand the analysis of the influence of factors on the balance of the market, in terms of skills. • Having the ability to apply the knowledge learned to study the nature of economic phenomena, the laws, and

	trends of the phenomena, and the laws of the market economy. • Ability to apply the knowledge learned in the study of macroeconomics, development economics, and several other economic subjects. Skills: • Forming and developing (one step) capacity to collect information, skills to synthesize and systematize issues in an overall relationship; skills to compare, analyze, comment, and evaluate micro-economic issues. • Develop reasoning and public speaking skills. Attitude: • Trying to be righteous in recognizing and evaluating the lines, policies, and laws of the State of Vietnam in the development of the market economy with the state's regulation. • Other Objectives: • Through presentations and problem-solving. Forming and developing collaboration and teamwork skills. • Develop skills of creative thinking, discovery, and discovery. • Cultivate and develop assessment and selfassessment capacity. • Develop public speaking and commenting skills.
Content	The course presents some basic problems of economics; principles of economics, supply and demand patterns and market equilibrium; theory of consumer behavior and business behavior; types of markets; aggregate supply, aggregate demand, and measure national output. The moduls includes the following chapters: Chapter 1: Economics and Fundamental Issues Chapter 2: Markets, Supply and Demand, and Market Equilibrium Chapter 3: Theory of Consumer Behavior Chapter 4: Production Cost Theory and Profit Maximization Chapter 5: National Output Measurement, Inflation, and Unemployment

Examination forms	Homework: 20%. Midterm exam: 20%. Final exam: 60%.
Study and examination requirements	Regulations on time, attendance, and discipline in the course: attend class on time and at least 70% of the sessions (only to be absent for a maximum of 30%). Exam ban is applied to those who miss more than the regulated number of sessions. Students must have all test scores, lively discussions, constructive and serious statements in class.
Reading list	

8. Psychology - BAA00006

Module designation	Psychology
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	MSc. TRAN Huong Thao
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Do lecturing, teamwork, divide students into groups to solve problems
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 90 hours. Contact hours (lecture): 30 hours. Private study including examination preparation, specified in hours: 60 hours.
Credit points	2 credits / 3 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Knowledge: • Understand the system of basic concepts of psychological science and research methods in psychology. • Understand the origin, formation and development of psychology and consciousness. • Understand the nature of human psychological processes: perception; emotion - affection; act. • Identify human psychological states.

	• Understand the psychological attributes that make up the personality structure. Understand the factors affecting the formation and development of personality. Skills: • Developing the capacity to study documents: Analyze, synthesize, compare, and generalize. • Form and develop the ability to identify psychological phenomena and apply learned knowledge to solve practical problems. • Consulting and consulting skills. Attitude: • Cultivate a passion for learning and studying subjects. • Forming a sense of initiative and positivity in selfstudy. • Form the right motivation in learning. • Raise a sense of responsibility for group activities. Other goals: • Forming personality qualities in accordance with the requirements of the integration period. • Forming communication and behavioral skills in the community. • Forming a modern and scientific way of living and working. • Forming and developing the ability to think creatively, independently, and critically. • Reasoning skills, public speaking skills. Form and develop teamwork skills.
Content	The course introduces to learners to acquire basic knowledge about the nature and characteristics of psychological phenomena and basic psychological laws of humans (perception, emotion, will, etc.) actions and personalities...). On that basis, it helps learners to apply knowledge in practice to identify and distinguish basic psychological phenomena in humans. This module includes the following parts: Part 1: The Natural Basis and Social Foundation of Human Psychology. Part 2: Perception and Learning. Part 3: Emotions – Affections. Part 4: Personality and the Formation of Personality.

	Part 5: Deviations in Individual Psychological Behavior and Correcting Such Deviant Behavior.
Examination forms	Class discussion; Group presentations and reports. Mid-term exam: essay (opened book). Final exam: essay (closed book).
Study and examination requirements	Regulations on time, attendance, and discipline in the course: attend class on time and at least 70% of the sessions (only to be absent for a maximum of 30%). Exam ban is applied to those who miss more than the regulated number of sessions. Students must have all test scores, lively discussions, constructive and serious statements in class.
Reading list	Main textbook: 1. Nguyễn Quang Uẩn (2015). Giáo trình Tâm lý học đại cương. References: 2. Plotnik, R, Kouyoumdjian, H (2011). Introduction to Psychology. 3. Berstein, D. A., Penner, L. A., Clarke-Stewart, A., and Roy, E (2008). Psychology.

9. Team-working and learning skills – BAA00008

Module designation	Team-working and learning skills
Semester(s) in which the module is taught	2th semester
Person responsible for the module	MSc. Tran Huong Thao
Language	Vietnamese
Relation to curriculum	General
Teaching methods	Do lecturing, teamwork, divide students into groups to solve problems
Workload (incl. contact hours, self-study hours)	Total: 60 hours Contact hours: lectures 30 hours *(in-class)*. Private study: 30 hours *(self-study)*.
Credit points	2 credits / 3 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	General objectives: • Specific objectives/subject output standards: Equip students with knowledge and skills about teamwork and study skills. Bringing career orientations to group work practice topics. • Skills: teamwork, presentation, communication • Attitude, diligence: serious, diligent, positive
Content	Understand the concept of groups, how to form groups, classify groups, functions, and tasks of group members. Know the process of teamwork, the necessary skills when working in groups. Able to plan and execute projects. Understand and apply learning skills.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Thuật lãnh đạo nhóm, NXB Trẻ. 2. Học tập cũng cần chiến lược, NXB Lao động Xã hội

10. English 1 - BAA00011

Module designation	English 1
Semester(s) in which the module is taught	1st semester
Person responsible for the module	Lecturers at Foreign language center of University of Science
Language	English
Relation to curriculum	Fundamental Knowledge
Teaching methods	Do lecturing, teamwork, divide students into groups to solve problems
Workload (incl. contact hours, self-study hours)	Total: 120 hours. Contact hours: lectures 15 hours; 30 exercise hours + 30 practical lessons. Private study: 60 hours (self-study)
Credit points	3 credits / 5.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Upon completing this course, learners will enhance their basic knowledge of general English of vocabulary and grammar in four skills: Listening, Speaking, Reading, and Writing. Here are the objectives in detail: ● Learners will be able to understand and use vocabulary in various topics such as leisure activities, important life events, emotion, attitude, physical appearance description, travel plans, presenting dreams, countries, people, and languages. ● Learners can understand and use grammar structures at the pre-intermediate level such as basic tenses and other related matters. ● Learners will be able to choose the answer that best describes the given picture, choose the correct response to the questions, and understand dialogues and short monologues. ● Learners will be able to pronounce single words, word clusters and sentences, describe a given picture, and build basic communications in daily life. ● Learners will be able to comprehend 300–500 words passage of familiar topics and gain more knowledge of different cultures around the world.

	● Learners can write essays about familiar topics related to daily life, learning activities, entertainment, events, etc.
Content	This course is designed for non-English major students at the University of Science - Vietnam National University - Hochiminh City, using the first eight modules in the book New Cutting Edge (Pre-intermediate). These modules cover vocabulary, grammar, reading, listening, speaking, and writing in a wide range of topics such as leisure activities, important life events, feelings and emotions, attitudes, physical appearance
	descriptions, travel plans, presenting dreams, countries, people, and languages. Students need to complete various tasks, including presentations, debates, role-plays, assignments, tests and so on.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1.Sarah Cunningham, Peter Moor, Jane Cornyns Carr (2005). New Cutting Edge, pre-intermediate: student's book. Harlow: Pearson Education. 2. Sarah Cunningham, Peter Moor, Jane Cornyns Carr (2005). New Cutting Edge, pre-intermediate: workbook. Harlow: Pearson Education.

11. English 2 - BAA00012

Module designation	English 2
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Lecturers at Foreign language center of University of Science
Language	English
Relation to curriculum	Fundamental Knowledge
Teaching methods	Do lecturing, teamwork, divide students into groups to solve problems
Workload (incl. contact hours, self-study hours)	Total: 120 hours. Contact hours: lectures 15 hours; 30 exercise hours + 30 practical lessons. Private study: 60 hours (self-study)
Credit points	3 credits / 5.5 ECTS

Required and recommended prerequisites for joining the module	English 1
Module objectives/intended learning outcomes	Upon completing this course, learners will enhance their basic knowledge of general English of vocabulary and grammar in four skills: Listening, Speaking, Reading and Writing. Here are the objectives in detail: - Learners will be able to understand and use vocabulary in various topics such as everyday items, important life events, holiday plans, health problems, hobbies and interests, personalities, finance- related issues. - Learners can understand and use grammar structures in pre-intermediate level such as basic tenses and more complex grammatical structures including conditional sentences, passive, and verb patterns. - Learners will be able to choose the correct response for the questions and understand dialogues and short monologues. - Learners will be able to pronounce words, generate short conversations, discuss real-life familiar topics, understand, and quickly respond to generated questions, and improve basic communication skills in daily life. - Learners will be able to comprehend 500 - 700 words spassages of familiar topics, and gain more knowledge of different cultures around the world. - Learners can write appropriate responses to written requests or complaints in business and social contexts, applying theories into real life practice.
Content	This course is designed for non-English major students at the University of Science - Vietnam National University - Ho Chi Minh City, using seven modules (modules 09-15) in the book New Cutting Edge (Pre-intermediate). These modules cover vocabulary, grammar, reading, listening, speaking and writing in a wide range of topics such as everyday items, important life events, holiday plans, health problems, hobbies and interests, personalities, and finance-related issues. Students need to complete various tasks, including presentations, debates, role-plays, assignments, tests and so on.

Examination forms	Writing (Midterm: 30%, Final exam: 70%)
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1.Sarah Cunningham, Peter Moor, Jane Cornyns Carr (2005). New Cutting Edge, pre-intermediate: student's book. Harlow: Pearson Education. 2. Sarah Cunningham, Peter Moor, Jane Cornyns Carr (2005). New Cutting Edge, pre-intermediate: workbook. Harlow: Pearson Education.

12. English 3 - BAA00013

Module designation	English 3
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	Lecturers at Foreign language center of University of Science
Language	English
Relation to curriculum	Intermediate Knowledge
Teaching methods	Do lecturing, teamwork, divide students into groups to solve problems
Workload (incl. contact hours, self-study hours)	Total: 120 hours. Contact hours: lectures 15 hours; 30 exercise hours + 30 practical lessons. Private study: 60 hours (self-study)
Credit points	3 credits / 5.5 ECTS
Required and recommended prerequisites for joining the module	English 2

Module objectives/intended learning outcomes	Upon completing this course, learners will enhance their basic knowledge of general English of vocabulary and grammar in four skills: Listening, Speaking, Reading and Writing. Here are the objectives in detail: Learners will be able to understand and use vocabulary in various topics such as leisure activities, important life events, emotion, attitude, physical appearance description, travel plans, dreams, countries, people, and languages. Learners can understand and use new language in a natural, communicative way. Learners will be able to present their opinions about some social and cultural issues and understand dialogues and talks. Learners will be able to comprehend 500-700 words passages of familiar topics, and gain more knowledge of different cultures around the world. Learners can write paragraphs about familiar topics related to daily life, learning activities, entertainment, events, etc.
Content	This course is designed for non-English majors at the University of Science - Vietnam National University - Hochiminh City, using the first six modules in the book New Cutting Edge (Intermediate). These modules cover vocabulary, grammar, reading, listening, speaking and writing in a wide range of topics, namely leisure activities, important life events, feelings and emotions, attitudes, physical appearance descriptions, travel plans, presenting dreams, countries, people, and languages. Students need to complete various tasks, including presentations, debates, role-plays, doing homework, tests and so on.
Examination forms	Writing (Midterm: 30%, Final exam: 70%)
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1.Sarah Cunningham, Peter Moor, Jane Cornyns Carr (2005). New Cutting Edge, Intermediate: student's book. Harlow: Pearson Education. 2.Sarah Cunningham, Peter Moor, Jane Cornyns Carr (2005). New Cutting Edge, Intermediate: workbook. Harlow: Pearson Education. 3. Materials prepared by the lecturer

13. English 4 - BAA00014

Module designation	English 4
Semester(s) in which the module is taught	4th semester
Person responsible for the module	Lecturers at Foreign language center of University of Science
Language	English
Relation to curriculum	Intermediate Knowledge
Teaching methods	Do lecturing, teamwork, divide students into groups to solve problems
Workload (incl. contact hours, self-study hours)	60
Credit points	3 credits / 5 ECTS
Required and recommended prerequisites for joining the module	English 3
Module objectives/intended learning outcomes	Upon completing this course, learners will enhance their intermediate knowledge of general English of vocabulary and grammar in four skills: Listening, Speaking, Reading and Writing. Here are the objectives in detail: Learners can understand and use the language needed in more complex real-life situations in a natural, communicative way. Learners will be able to express their own ideas in interviews, mini-talks, problem-solving and story¬telling. Learners will be able to comprehend 700-1000 words passages of up-to-date topics of international interest, and learn more about the world and other cultures. Learners can write essays about familiar topics related to daily life, learning activities, entertainment, events, etc.
Content	This course is designed for non-English majors at the University of Science - Vietnam National University - Ho Chi Minh City, using six modules (modules 07-12) in the book *New Cutting Edge* (Intermediate). These modules cover vocabulary, grammar, reading, listening, speaking and writing in a wide range of topics namely *everyday items, important life events, holiday plans, health problems, hobbies and interests, personalities,* and *finance-related issues.* Students need to complete various tasks, including presentations, debates, role-plays, doing homework, tests and so on.

Examination forms	None
Study and examination requirements	Mid-term test: 50%, Final test: 50%
Reading list	1. Sarah Cunningham, Peter Moor, Jane Cornyns Carr (2005). New Cutting Edge, Intermediate: student's book. Harlow: Pearson Education.
	2.Sarah Cunningham, Peter Moor, Jane Cornyns Carr (2005). New Cutting Edge, Intermediate: workbook. Harlow: Pearson Education. 3. Materials prepared by the lecturer. 4. (2012). Collins Skills for the TOEIC test: Speaking and Writing. Harper Collins UK.

14. Analysis 1A – MTH00010

Module designation	Analysis 1A
Semester(s) in which the module is taught	1st semester
Person responsible for the module	Dr. Ong Thanh Hai, Department of Analysis
Language	Vietnamese
Relation to curriculum	General
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	135 Hours Contact hours: Lectures: 45 hours (in class) Private study: 90 hours (self-study)
Credit points	3 Credits/4.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	The objective of the module is to equip students with the basic knowledge of the foundation of calculus as the foundation for specialized modules.
Content	The course covers the basics of real numbers, sequences and series of real numbers.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	[1] Mathematica by example, Academic Press, New York Calculus, Harcourt Brace College Publishers, New York

	[2] Giáo trình Giải tích 1. Nhà xuất bản Thống Kê, Tp Hồ Chí Minh

15. Calculus 1A – MTH00011

Module designation	Calculus 1A
Semester(s) in which the module is taught	1st semester
Person responsible for the module	MSc. Nguyen Vu Huy, Department of Analysis
Language	Vietnamese
Relation to curriculum	General
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	135 Hours Contact hours: Lectures: 45 hours (in class) Private study: 90 hours (self-study)
Credit points	3 Credits / 4.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	The objective of the module is to equip students with the basic knowledge of calculus as the foundation for specialized modules.
Content	The course covers the basics of continuity, limit, derivative, Riemann integral.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Mathematica by example, Academic Press, New York 2. Calculus, Harcourt Brace College Publishers, New York 3. Giáo trình Giải tích 1. Nhà xuất bản Thống Kê, Tp Hồ Chí Minh

16. Analysis 2A - MTH00012

Module designation	Analysis 2A
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Dr. Ong Thanh Hai, Department of Analysis
Language	Vietnamese
Relation to curriculum	General
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	Total hours: 75 Hours Contact hours: Lectures 30 hours (in class) Private study: 45 hours (self-study)
Credit points	2 Credits / 3 ECTS
Required and recommended prerequisites for joining the module	Analysis 1A
Module objectives/intended learning outcomes	- General objective: To introduce the basic concepts and techniques of metric topology for multivariable functions and vectors. - Specific objectives: • Knowledge: know the basic concepts of metrics, closed, open, compact sets, completeness, series in normed space. • Skills: do exercises that demonstrate the above concepts and their applications
Content	This module helps students understand basic topological concepts, understand convergence in multi-dimensional spaces and function spaces. The course introduces metric spaces, normative spaces and Rn; properties of continuous functions on metric spaces. Completeness of spaces and series on complete normed space. This knowledge forms the basis for all specializations such as analysis, statistics and probability, computer science, optimization, applied mathematics.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	Assignments: 20%, Midterm Exam: 30%, Final Exam: 50%
Reading list	Giáo Trình Giải tích A2, NXB ĐHQG Tp HCM, Đặng Đức Trọng, Đinh Ngọc Thanh, Phạm Hoàng Quân

17. Calculus 2A – MTH00013

Module designation	Calculus 2A
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Dr. Nguyen Thi Hoai Thuong, Dr. Phan Thi My Duyen - Department of Analysis
Language	Vietnamese
Relation to curriculum	General
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	135 Hours Contact hours: Lectures: 45 hours (in class) Private study: 90 hours (self-study)
Credit points	3 Credits / 4.5 ECTS
Required and recommended prerequisites for joining the module	Calculus 1A
Module objectives/intended learning outcomes	- General Objective: To introduce the basic concepts and techniques of differentiable calculus of multivariable vector functions. - Specific objectives: • Knowledge: The theory of series of real numbers. Properties of differentiable functions on Rn. • Skills: be able to do calculation exercises on the above concepts and their applications
Content	This module helps students understand the basic knowledge of differential calculus of multivariable functions, understand bound and unconstrained extremal problems in multidimensional spaces, and understand the concept of series of real numbers. This knowledge forms the basis for all specializations such as analysis, statistics and probability, computer science, optimization, applied mathematics.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	Assignments: 20%, Midterm Exam: 30%, Final Exam: 50%
Reading list	Giải tích A2, NXB ĐHQG Tp HCM, Đặng Đức Trọng, Đinh Ngọc Thanh, Phạm Hoàng Quân.

18. Analysis 3A – MTH00014

Module designation	Analysis 3A
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	Assoc. Prof. Ly Kim Ha - Department of Analysis
Language	Vietnamese
Relation to curriculum	General
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: lectures 45 hours + 30 exercises hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 5.5 ECTS
Required and recommended prerequisites for joining the module	Analysis 1A, Calculus 1A, Analysis 2A
Module objectives/intended learning outcomes	- General objective: Learners have an understanding of the integral of functions of many variables and the relationships between the differential and integral of functions of many variables. - Specific objectives: • Knowledge: The minimum outcome standard is at the level in J. Stewart's Calculus textbook for science and engineering students. The average level is towards more advanced, more suitable for Mathematics majors, with higher requirements for accuracy and theoretical content. For fairly good students and honor students the course aims for qualifications in the respective sections of classic analysis textbooks such as those of W. Rudin, S. Lang. • Skills: Introduction to computer tools. Exercises include both reasoning and calculation. • Attitude, diligence: Seeing the need to develop generalization and precision, forming an ability to solve new application problems. Having a serious, proactive and self-disciplined learning attitude.
Content	This is a course on Multiple Integration and Vector Calculus. This subject follows the subjects of Calculus 1 and Calculus 2, which is considered a basic knowledge for university level in Science and Technology. A useful course for more advanced investigations of Lebesgue integrals (Measurement

	and Probability), mathematical models using Integral (in Mechanics, Probability-Statistics, Mathematical Equations, Calculus, ...), and mathematical developments (in Analysis, Geometry, ...)
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	Assignments: 20%, Midterm Exam: 30%, Final Exam: 50%. + Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Bài giảng Tích phân bội và Giải tích Vectơ, Huỳnh Quang Vũ. 2. Calculus: Early Transcendentals, James Stewart.

19. Analysis 4A – MTH00015

Module designation	Analysis 4A
Semester(s) in which the module is taught	4th semester
Person responsible for the module	Dr. Le Anh Ha - Department of Analysis
Language	Vietnamese
Relation to curriculum	General
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	135 hours Contact hours: lectures 45 hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	3 Credits / 4.5 ECTS
Required and recommended prerequisites for joining the module	Analysis 1A, Analysis 2A.
Module objectives/intended learning outcomes	- General objective: To introduce basic differential equations and know how to solve basic ordinary differential equations. - Specific objectives/course outcome standards: • Knowledge: Master the course content. • Skills: Ability to calculate with large numbers of calculations • Attitude, diligence: Diligent and serious
Content	This module equips math majors with a minimum of background knowledge before entering narrower specializations. The content of this course includes Differential equations of first order; Existence and uniqueness of solutions of Cauchy problem; Linear

	differential equations of second and higher order; Introduction to the system of differential equations of first order.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	Midterm Exam: 20%, Final Exam: 80%
Reading list	1. Bài giảng Giải tích A4, 2012, Nguyễn Thành Long. 2. Phép tính vi phân hàm nhiều biến và phương trình vi phân, Nguyễn Thành Long, Nguyễn Công Tâm, Lê Thị Phương Ngọc, Nguyễn Anh Triết.

20. Linear Algebra – MTH00030

Module designation	Linear Algebra
Semester(s) in which the module is taught	2nd
Person responsible for the module	Dr. Le Van Luyen, Dr. Bui Anh Tuan - Department of Algebra
Language	Vietnamese
Relation to curriculum	General
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	135 hours Contact hours: lectures 45 hour (in class) Private study: 90 hours (self-study)
Credit points	3 Credits / 4.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- General objectives: To be familiar with advanced mathematics. - Specific objectives/course learning outcomes: · Knowledge: Mastering the knowledge of matrices on number fields and applying them to solving systems of linear equations; determinants and their applications; vector spaces and linear transformations. · Skills: Calculating on matrices; solving system of linear equations; calculating the coordinates of the vector according to a basis in a finite dimensional vector space; changing when changing the base; representing a linear operator by a matrix; finding the image and the kernel of linear operators; using MAPLE software. · Attitude: Attend all classroom sessions; discussions outside

	of class time.
Content	This course is taught in the first semester, initially introducing students to advanced mathematics. Beside equipping new knowledge that is necessary for freshman, this course also provides the foundation knowledge to help students carry out specialized courses.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	Midterm: 40% Final: 60%
Reading list	[1] *Đại số tuyến tính và ứng dụng, Tập 1,* Bùi Xuân Hải, Trần Ngọc Hội, Trịnh Thanh Đèo, Lê Văn Luyện. [2] *Giáo trình Đại số tuyến tính,* Ngô Việt Trung.

21. Higher Algebra – MTH00031

Module designation	Higher Algebra
Semester(s) in which the module is taught	3rd
Person responsible for the module	Dr. Le Van Hop - Department of Algebra
Language	Vietnamese
Relation to curriculum	General
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	135 hours Contact hours: lecturesl 45 hour (in class) Private study: 90 hours (self-study)
Credit points	3 Credits / 4.5 ECTS
Required and recommended prerequisites for joining the module	Linear Algebra
Module objectives/intended learning outcomes	The goal of the course is to equip students with basic abstract algebraic structures, to help them become familiar with symbols and formal calculations.
Content	The course introduces basic algebraic structures such as groups, rings, integer domains, fields, and polynomial rings on fields. Some special concepts introduced are permutation group, alternating group, cyclic group, polynomial ring on number fields, especially on rational number fields.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.

Reading list	[1] Nguyễn Viết Đông, Trần Ngọc Hội, *Đại số đại cương*, NXB ĐHQG TP HCM 2005. [2] Hoàng Xuân Sính, *Đại số đại cương*, NXB GD, Hà Nội 1997. [3] Nguyễn Hữu Việt Hưng, *Đại số đại cương*, NXB GD 1998. [4] Mỵ Vinh Quang, *Đại số đại cương*, NXB GD 1998. [5] Bùi Huy Hiền, Nguyễn Hữu Hoan, Phan Doãn Thoại, *Bài tập Đại số và Số học (tập 1, 2)*, NXB GD 1985.

22. Introduction to computer programming – MTH00055

Module designation	Introduction to computer programming
Semester(s) in which the module is taught	2nd
Person responsible for the module	MSc. Nguyen Hien Luong, MSc. Ha Van Thao - Department of Computer Science
Language	Vietnamese
Relation to curriculum	General
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 lab hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 4.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Introduce to students the basic knowledge and principles of computer programming and the C/C++ programming language
Content	-Basic concepts of algorithms and algorithms. -Describe the skills and fundamentals of computer programming. - Introduction to the C programming language.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	[1] Brian W. Kernighan, Dennis. M. Ritchie (1988), *The C Programming Language 2nd*, Prentice Hall PTR. [2] Robert Sedgewick (1994), *Algorithms*, Addison Wesley. [3] Donald E. Knuth (1997), *The Art of Computer Programming – Vol 2 3rd*, Addison Wesley.

23. Linear Algebra Practice – MTH00083

Module designation	Linear Algebra Practice
Semester(s) in which the module is taught	2nd
Person responsible for the module	MSc. Pham The Nhan - Department of Algebra
Language	Vietnamese
Relation to curriculum	General
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	60 hours Contact hours: 30 lab hours (in class) Private study: 30 hours (self-study)
Credit points	1 Credits / 2 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	General objectives: To help students understand more linear algebra via doing exercise. - Specific objectives/course learning outcomes: · Knowledge: Mastering the knowledge of matrices on numerical fields and applying them to solving systems of linear equations; determinants and their applications; vector spaces and linear transformations. · Skills: Calculating on matrices; solving system of linear equations; calculating the coordinates of the vector according to a basis in a finite dimensional vector space; changing when changing the base; representing a linear operator by a matrix; finding the image and the kernel of linear operators; using MAPLE software. · Attitude: Attend all classroom sessions; discussions outside of class time.
Content	This course is taught in the first year, initially introducing students to advanced mathematics. Beside equipping new knowledge that is necessary for freshman, this course also provides the foundation knowledge to help students carry out specialized courses.
Examination forms	Tests – process score: 30% Midterm exam: 30% Final exam: 40%
Study and examination requirements	Midterm and final exam: written exams.
Reading list	[1] Đại số tuyến tính và ứng dụng, Tập 1, Bùi Xuân Hải, Trần Ngọc Hội, Trịnh Thanh Đèo, Lê Văn Luyện.

	[2] Giáo trình Đại số tuyến tính, Ngô Việt Trung [3] Phạm Huy Điển, **Tính toán, lập trình và giảng dạy toán học trên Maple**, 2009

24. Computational Softwares Laboratory – MTH00087

Module designation	Computational Softwares Laboratory
Semester(s) in which the module is taught	2nd
Person responsible for the module	Dr. Ông Thanh Hải, Department of Analysis
Language	Vietnamese
Relation to curriculum	General
Teaching methods	lectures, computer practices
Workload (incl. contact hours, self-study hours)	120 hours Contact hours: 60 lab hours (in class) Private study: 60 hours (self-study)
Credit points	2 Credits / 4 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Students can use computational programming languages to program calculations in mechanics, analysis, numerical analysis, algebra, statistics…
Content	The course covers basic computational programming knowledge using Matlab... Applying this knowledge to write programs to solve problems in mechanics, analysis, numerical analysis, algebra,...
Examination forms	Tests – process score: 30% Midterm exam: 30% Final exam: 40%
Study and examination requirements	Midterm and final exam: practical exercises in laboratory. + Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Essential MATLAB ® for Engineers and Scientists, 3rd edition, Elsevier Brian D. Hahn and Daniel T. Valentine, 2007. 2. Numerical methods using Matlab. Third Edition. Prentice Hall J. H. Mathews, K. D. Frink, 1999.

25. Higher Algebra Practice – MTH00084

Module designation	Higher Algebra Practice
Semester(s) in which the module is taught	3rd
Person responsible for the module	Dr. Nguyen Kim Ngoc – Department of Algebra
Language	Vietnamese
Relation to curriculum	General
Teaching methods	lectures, computer practices
Workload (incl. contact hours, self-study hours)	120 hours Contact hours: 60 lab hours (in class) Private study: 60 hours (self-study)
Credit points	1 Credits / 2 ECTS
Required and recommended prerequisites for joining the module	Linear algebra, Linear algebra practice
Module objectives/intended learning outcomes	General Objective: To equip students with basic computational skills in abstract algebraic structures, formal calculation, giving them a better understanding of these algebraic structures. Use softwares (e.g. GAP) to calculate specific examples and exercises. Specific objectives/course learning outcomes: • Knowledge: Master the theory of basic algebraic structures such as groups, rings, fields, and polynomial rings. Get hands-on with softwares (e.g. GAP) to better understand the structure learned. • Skills: Improve reasoning skill and formal calculation. • Attitude, diligence: Serious, progressive.
Content	The goal is to practice basic computational skills on algebraic structures such as groups, rings, integral domains, and fields, and use softwares (e.g. GAP) to better understand the structure of theories learned.
Examination forms	Tests – process score: 30% Midterm exam: 30% Final exam: 40%
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	[1] *Đại số đại cương,* Nguyễn Viết Đông, Trần Ngọc Hội, 2005. [2] *Đại số đại cương,* Hoàng Xuân Sính, 1997. [3] Abstract Algebra in GAP, Alexander Hulpke 2011.

26. Environmental Studies – ENV00001

Module designation	Environmental studies
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	Lecturers at Faculty of Enviroment
Language	Vietnamese
Relation to curriculum	General
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	90 hours Contact hours: lectures 30 hour *(in class)* Private study: 60 hours *(self-study)*
Credit points	2 credits / 3 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	This is a compulsory subject in the general knowledge block in the training program for students of all disciplines. The focus of this module is to provide basic knowledge of Environmental Science: concepts, classification of resources, environment, basic problems and core of the environment. Students are also introduced to measures to protect the environment, conserve resources towards the goal of sustainable development.
Content	Chapter 1: Overview of the Environment 1. General concepts of environment 2. Basic composition of the environment (volumes) Chapter 3: Natural Resources 1. Definition 2. Classification 3. General issues of natural disaster Chapter 4: Human Impact on the environment 4.1 History of human impact on the environment 4.2 Human impact on environmental components Chapter 5: Environmental issues and sustainable development 5.1 Population and environment 5.2 Environmental pollution 5.3 Climate change 5.4 Sustainable development

	Chapter 6: Environmental management and Environmental Education
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	Midterm test: 30% Final test: 70%
Reading list	Textbooks: [1] Lecture on General Environment, compiled by the group of teachers. [2] Le Van Khoa (Editor),2004. Environmental science, Education Publishing House. References [3] Le Van Khoa, Doan Van Canh, Nguyen Quang Hung, Lam Minh Triet (2011). Textbook of People and the Environment, Education Publishing House. [4] Goudie, A. (2006) The Human Impact on Natural Environment. 6th Edition. Oxford. Blackwell [5] Le Thi Thanh Mai (2008), Textbook of People and the Environment. National University of Ho Chi Minh City.

27. Earth science – GEO00002

Module designation	Earth science
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	Lecturers at Faculty of Geology, VNUHCM-University of Science
Language	Vietnamese
Relation to curriculum	General
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	Total: 60 hours. Contact hours: 30 lectures hours (in class) Private study: 30 hours (self-study)
Credit points	2 credits / 3 ECTS
Required and recommended prerequisites for joining the module	None

Module objectives/intended learning outcomes	Earth Science introduces general knowledge about the Earth related to the rights of the Earth, inside and outside the Earth including position and operation of the earth in space; composition and structure of the atmosphere, wind, and weather, climate, climate change; distribution of fresh water in hydrosphere, sea and ocean behavior, El Nino-La Nina phenomena: Geosphere: composition and structure of the earth's crust, weathering, erosion-accumulation, landslides, the internal structure of the earth, earthquakes, volcanoes, plate tectonic activities; learn about the history of the earth through the record of fossil remains. Knowledge of Earth science is a necessary basis for understanding the natural environment of the Earth.
Content	Presentation on deformations of the earth's crust and earthquake, volcanic activities and membrane tectonic mechanism Learn about Earth's history through fossil and stratigraphic records. Apply this knowledge to explain some issues in the main profession Skilled in group discussion, presentation and criticism Attitude, diligence: enthusiasm, honesty in learning; Serious and honest in checking.
Examination forms	Writing (Midterm: 30%, Final exam: 70%)
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Earth Science, DANIELSON, E.W., DENECKE. EJ..Ir..l986. 2. Foundations of Earth Science, Lutgens Frederick K. Tarbuck Edward .1, 1997. 3. Earth Science Textbook, LUU DUC HAI, TRAN NGHI. 2008.

29. General Chemistry 1 – CHE00001

Module designation	General Chemistry 1
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Lecturers at Faculty of Chemistry of University of Science
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Do lecturing, teamwork, divide students into groups to solve problems
Workload (incl. contact hours, self-study hours)	150 Hours Contact hours: Lectures: 30 hours (in class) Exercise: 30 hours Private study: 90 hours (self-study)
Credit points	3 Credits / 5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	This subject is the first Chemistry subject for students of Chemistry and Materials Science. The subject deals with the theoretical foundations of Chemistry related to the basic models of the atomic structure, the periodic changes in the properties of chemical elements, the fundamental forces of interaction in the matter, and the influence of chemical elements. their influence on the properties of matter in the solid, liquid, and gaseous states.
Content	Describe the structure of atoms and molecules. Explain periodic changes in some properties of chemical elements. Identify and distinguish basic types of chemical bonds. Identify and explain the relationship between the fundamental forces of interaction in matter and the physical properties of matter.
Examination forms	Written exam Midterm test: 30% Final test: 70%
Study and examination requirements	Minimum attendance at lectures is 80% Final score is greater or equal to 5.0/10.0
Reading list	Textbooks: [1] Nguyen Dinh Chi (2007). General chemistry. Hanoi Education Publishing House [2] Nguyen Dinh Soa (2000). General chemistry. Ho Chi Minh City National University Publishing House [3] Petrucci, R.H; Harwood, W.S; Herring, F.G (2002, 8th Ed.). General Chemistry. USA: Prentice Hall Others:

	[4] Le Thi So Nhu. Summary of General Chemistry lecture - internal documents (For internal circulation only)

30. General Physics 1 (Mechanics - Thermodynamics) – PHY00001

Module designation	General Physics 1 (Mechanics and Thermodynamics)
Semester(s) in which the module is taught	1st semester
Person responsible for the module	Prof. CHAU Van Tao
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, discussion, debate.
Workload	135 Hours Contact hours: Lectures: 45 hours (in class) Private study: 90 hours (self-study)
Credit points	3 Credits/ 4.5 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	This course covers the principles of kinematics, dynamics, statics, work, energy, linear momentum, gravitation, and thermodynamics. Students who complete this module could be achieved the following: - Knowledge: Be able to understand and apply laws of mechanics to explain physical phenomena and solve problems; Be able to understand and apply mechanisms of heat transfer, equations of state, the first and the second law of thermodynamics. - Skills: Be able to work at individual level and group work. - Competences: Ability to apply mechanics and thermodynamics knowledge to analyze physical situations. - Attitude: Honest

Content	This module includes the following topics: 7. Physics and measurement 8. Kinematics of particles 9. Force and Newton's laws 10. Conservation laws in classical mechanics 11. Kinetics of rigid bodies 12. The ideal gas 13. The first law of thermodynamics 14. The first law of thermodynamics
Examination forms	Class discussion; quizzes and projects; Mid-term and Final exam: Written exam (closed-book)
Study and examination requirements	● Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) ● Final score is greater or equal to 5.0/10.0
Reading list	Main books: 1. Nguyen Nhat Khanh (2005). Mechanics and thermodynamics lectures. VNUHCM Publishing House, Vietnam. References: 2. Nguyen Thanh Van. (2013) General Physics 1. VNUHCM Publishing House, Vietnam. 3. Raymond A. Serway, John W. Jewett, Sr, (2014). Physics for Scientists and Engineers with Modern Physics. Brooks/Cole Publishing Company, USA. 4. Alan Giambattista, Betty McCarthy Richardson, Robert C. Richardson, (2010). Physics. McGrawHill Companies, Inc, USA.

31. General physics 2 (Electromagnetic - Optics) – PHY00002

Module designation	General Physics 2 (Electromagnetism - Optics)
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Assoc. Prof. HUYNH Truc Phuong
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, discussion, debate
Workload	135 Hours Contact hours: Lectures: 45 hour *(in class)* Private study: 90 hours *(self-study)*

Credit points	3 Credits/ 4.5 ETCS
Required and recommended prerequisites for joining the module	Calculus 1B, General physics 1
Module objectives/intended learning outcomes	This module provides basic knowledge of electric and magnetic fields and thereby an understanding of the laws and phenomena of light optics. Students who complete this module could be achieved the following: - Knowledge: Be able to understand and apply knowledge of electromagnetism and optics in science and life. - Skills: Be able to work at individual level and teamwork. - Competences: Ability to apply electromagnetism and optics knowledge to analyze physical situations. - Attitude: Honesty and diligence
Content	This module includes the following topics: 1. Electric charge and electric field 2. Conductors in an electric field 3. Electric current and magnetic field 4. Electromagnetic induction and applications 5. The background of light optics 6. Interference of light 7. Diffraction of light 8. Polarization of light
Examination forms	Oral presentation, Mid-term and Final exam: Written exam (closed-book)
Study and examination requirements	+ Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) + Final score is greater or equal to 5.0/10.0
Reading list	**Main books:** 1. Nguyen Thanh Van. (2015) General Physics 2. VNUHCM Publishing House, Vietnam. **References:** 1. Le Vu Tuan Hung (2015) Optics. VNUHCM Publishing House, Vietnam. 2. Raymond A. Serway, John W. Jewett, Sr (2014). Physics for Scientists and Engineers with Modern Physics. Ninth Edition. BROOK/COLE, USA. 3. Alan Giambattista, Betty McCarthy Richardson, Robert C. Richardson (2010). Physics. Second Edition. McGrawHill, USA.

32. General Physics Lab – PHY00081

Module designation	General Physics Lab
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	MSc. HUYNH Thanh Nhan
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lab works, discussion, practice
Workload (incl. contact hours, self-study hours)	120 Hours Contact hours: Lab works: 60 hours (in class) Private study: 60 hours (self-study)
Credit points	2 Credits/ 4 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	This course is a practical subject in the laboratory. This course helps students understand how to measure some physical quantities, experimental errors, analyze and evaluate measurement results. Students who complete this module could be achieved the following: - Knowledge: Be able to describe the process, how to measure fundamental physical quantities in the laboratory. Be able to use instruments and equipment to measure experimental data of physical quantities correctly. Be able to determine (calculate) physical quantities from measured experimental data. Be able to determine the error of experimental measurement of physical quantities. - Skills: Be able to work in individual, group work, self-study, and problem solving. - Competences: Be able to analyze, process and write experimental data reports. - Attitude: be honest, responsible, respect for colleagues.
Content	In this module, Students practice 10 of the following 13 experiments: 1. Practice 1: Density of liquid and solids. The private mass of the metals 2. Practice 2: Viscosity. Viscosity is dependence of different temperature 3. Practice 3: Reversible pendulum. The Mathematical pendulum

	4. Practice 4: Heat of function for ice. Determination of heat 5. Practice 5: Mechanical equivalent of heat. The heat capacity of metals 6. Practice 6: Wheatstone Bridge. Resistor is dependence of different temperature 7. Practice 7: Voltmeter and Ampemeter DC. Voltmeter and Ampemeter AC 8. Practice 8: AC circuit. RLC circuit 9. Practice 9: Diod characteristics 10. Practice 10: Transistor characteristics 11. Practice 11: Microscope. To measure diameter of other small object 12. Practice 12: Refraction by a prism. Dispersion and resolving power of the prisms 13. Practice 13: Polarization of light Rotatory power
Examination forms	Practice reports, practice exam
Study and examination requirements	+ Minimum attendance at Lab is 80% (Absences must not exceed 3 times for the entire duration of the lectures) + Final score is greater or equal to 5.0/10.0
Reading list	Main text books: Dang van Liet, Do Dinh Luyen, Nguyen Van Nghia, Tran Thi Kim Phuong, "General Physics Experiments", University of Science, -VNUHCM, 2008

33. Introduction to Informatics – CSC00003

Module designation	Introduction to Informatics
Semester(s) in which the module is taught	1st semester
Person responsible for the module	Lecturers at Center of Informatics, Univeristy of Science, VNU-HCM
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, problem, lab works
Workload (incl. contact hours, selfstudy hours)	otal workload: 165 hrs Contact hours: Lectures: 15 hours (in class) and lab works 60 hours Private study: 90 hours (self-study)
Credit points	3 Credits/ 5.5 ETCS
Required and recommended prerequisites for joining the module	None

Module objectives/intended learning outcomes	After completing the course, students will be able to: - Explain common concepts and terms related to the field of computer science. - Perform basic operations related to the Windows operating system and common software. - Create documents with professional format, structure, and presentation using software. - Analyze and organize data in spreadsheet format, use calculation, search, and statistical functions to create formulas for data processing and presentation. - Create eye-catching presentations. - Express concepts related to the Internet, information security on the network. - Be aware of searching for information and legal regulations regarding copying, sharing, and posting information on the Internet. - Design a basic electronic information page.
Content	1. Basic understanding of IT - Basic knowledge of computers and computer networks. - Access control, ensuring data security, Malware. - Basic legal issues in using IT. 2. Basic computer usage - Windows operating system - Windows Explorer - Control Panel - Data compression and extraction - Typing in Vietnamese 3. Basic Microsoft Word - Document composition - Text formatting - Creating tables - Handling graphics in documents - Page layout and printing 4. Basic Microsoft PowerPoint - Basic presentation templates - Creating a presentation - Setting up effects for the presentation 5. Basic Microsoft Excel - Data formatting in Excel - References in Excel

	- Basic Excel functions - Printing and creating charts 6. Internet usage - Basic knowledge of the Internet - Information searching - Information security 7. Web image processing - Resizing image frames - Image cropping - Image rotation and flipping - Adjusting the brightness of an image - Adjusting the contrast of an image 8. Designing a basic electronic information page using HTML & CSS3.
Examination forms	Multiple choice exam, practical exam
Study and examination requirements	Minimum attendance at lectures is 80% Final score is greater or equal to 5.0/10.0
Reading list	- Curriculum for Basic IT Applications, Advanced IT Applications. - Microsoft Office MOS materials, IIG Vietnam, Fahasha. - IC3 Spark materials, IIG Vietnam, Fahasha.

2. Foundational Professional Education

2.1. Basic knowledge and fundamentals for the founddations in concentrations

1. Measure Theory and Probability - MTH10401

Module designation	Measure Theory and Probability
Semester(s) in which the module is taught	3rd
Person responsible for the module	Prof. Đặng Đức Trọng
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 exercise hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Analysis A1, Analysis A2

Module objectives/intended learning outcomes	The objective of the module is to equip students with the basic knowledge of the foundation of measure theory and theory of the integral, and application of the measure theory in probability theory.
Content	1. Elementary probability theory, abstract measure theory. 2. Integration with respect to probability measures, expectation, and variance 3. Random variables, Law of large numbers and limit theorems. 4. Changes of measures and the Radon-Nikodym Theorem. 5. Conditional expectations, filtrations, and martingales.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	Exercises 20%; Mid-term 30%; Final exam 50%. + Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Đặng Đức Trọng, Đinh Ngọc Thanh, Giáo trình lý thuyết độ đo và xác suất, NXB ĐHQG Tp HCM, 2014. 2. K. L. Chung, A course in probability theory, 3rd edition, Academic Press, 2001. 3. D. M. Đức, Lý thuyết độ đo và tích phân, NXB Đại Học Quốc Gia Tp. HCM, 2006. 4. P.H. Quân, Đ.N. Thanh, Xác suất thống kê, NXBGD, 2011

2. Algebra A2 - MTH10402

Module designation	Algebra A2
Semester(s) in which the module is taught	4th
Person responsible for the module	Dr. Trần Ngọc Hội
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 exercise hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Prerequisite courses: Linear Algebra Course requirements: Mastery of systems of linear equations, vector spaces, linear transformations

Module objectives/intended learning outcomes	General objective: To equip students with basic knowledge of advanced linear algebra, as a foundation for specialized courses in Mathematics. Specific objectives course learning outcomes: Knowledge: Master the diagonalization and Jordanization of linear operators on finite-dimensional vector spaces, the structure of Euclidean spaces, bilinear forms, and quadratic forms. Skills: Diagonalization and Jordanization of matrices on numeric fields, computation in Euclidean space, quadratic transformations. Attitude, diligence: Serious, progressive.
Content	This course introduces the basic knowledge of linear operator reduction (diagonalization, Jordan canonical form), Euclidean space, bilinear form, and quadratic form.
Examination forms	Essay Exam
Study and examination requirements	Tests – process score: 50% Final exam: 50% + Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	[1] Đại số tuyến tính và Ứng dụng, Tập 2, Bùi Xuân Hải, Trần Ngọc Hội, Lê Văn Luyện, 2017. [2] Giáo trình Đại số tuyến tính, Ngô Việt Trung, 2000. [3] Đại số tuyến tính, Nguyễn Hữu Việt Hưng, 2004.

3. Functional Analysis - MTH10403

Module designation	Functional Analysis
Semester(s) in which the module is taught	4th semester
Person responsible for the module	Dr. Bùi Lê Trọng Thanh
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	lectures, practice sessions
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 exercise hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Analysis 1A, 2A, 3A

Module objectives/intended learning outcomes	General Objective: Functional analysis is where students get their first basic understanding of infinite-dimensional spaces. This knowledge is indispensable for many specializations in both theoretical and applied mathematics. This is one of the first courses where the ability to acquire and use abstract and precise mathematical reasoning is trained and tested. Specific objectives/course outcomes standards: Knowledge: understand and apply in specific situations some basic concepts and results about Euclidean spaces, l^p, L^p spaces, bounded functions spaces, space of continuous linear mappings, Hilbert space. Skills: systematically understanding the above objects, grasping the relationships between concepts and results. Distinguish and criticize arguments that do not meet the exact requirements of mathematics. Attitude, diligence: Seeing the need for generalized development, thereby helping to solve application problems, thereby having a serious, proactive, and self-disciplined learning attitude.
Content	Metric space, normed space, continuous linear mapping between two normed spaces and their fundamental theorems, Hilbert space. This subject is considered as the basic knowledge for university level Mathematics. An essential and useful course for mathematical models using function spaces and infinite dimensional spaces (in Algebra, Optimization, Probability-Statistics, Partial Differential Equations, Analysis, Mathematical Methods in Physics, Computer Science, ...).
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	Assignments: 50%; Final Exam: 50% + Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	[1] Bài giảng Giải tích hàm, Đinh Ngọc Thanh, Huỳnh Quang Vũ. [2] Giải tích hàm, Dương Minh Đức, 2005 [3] Giải tích hàm, Đinh Ngọc Thanh, Đặng Đức Trọng, 2011

4. Mathematical Statistics - MTH10404

Module designation	Mathematical Statistics
Semester(s) in which the module is taught	4th semester
Person responsible for the module	Dr. Hoàng Văn Hà
Language	Vietnamese

Relation to curriculum	Compulsory
Teaching methods	lectures, exercises, practice sessions
Workload (incl. contact hours, self-study hours)	Total: 145 hours. Contact hours: lectures 15 hours; 30 exercise hours + 30 practical lessons in laboratory. Private study: 70 hours (self-study)
Credit points	3 credits / 5.5 ECTS
Required and recommended prerequisites for joining the module	Measure theory and probability, Analysis A1
Module objectives/intended learning outcomes	This course provides foundations of statistical inference. Students will be able to make inferences from data, making decisions and prediction. Students can apply statistical techniques to practical problems using R or SPSS.
Content	1. Descriptive statistics. Sampling distributions. 2. Point estimations: definition, estimators, and estimates. Unbiasedness, efficiency, consistency. Method of moments, method of maximum likelihood, Bayes estimators. Minimum variance unbiased estimator, Cramer-Rao lower bound. 3. Confidence interval: CI for means, variances and proportions. 4. Hypothesis testing: basic concepts, null and alternative hypotheses, simple and compound hypotheses, type I and II errors, critical region, size and power of a test, p-value. Neyman - Pearson lemma. Likelihood Ratio tests. z-tests and t-tests. Goodness of fit test. 5. Linear Regression.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	Homework exercises: 10% Computing exercises: 20% Mid-term: 20%; Final exam: 50% + Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Casella, George, and Roger L. Berger. *Statistical inference*. Cengage Learning, 2021. 2. Lehmann, Erich Leo, Joseph P. Romano, and George Casella. *Testing statistical hypotheses*. Vol. 3. New York: Springer, 2005. 3. Montgomery, Douglas C., and George C. Runger. *Applied statistics and probability for engineers*. John Wiley & Sons, 2010.

5. Data Structure and Algorithm - MTH10405

Module designation	Data Structure & Algorithm
Semester(s) in which the module is taught	4th semester
Person responsible for the module	MSc. Hà Văn Thảo – Department of Computer Science
Language	Vietnamese
Relation to curriculum	Optional
Teaching methods	Learning materials provide full for students at first lessons including: slide lectures, seminar topics, theory, and practice exercises. Students'self-study, homework, practice, and seminars in groups. Students attend full lectures and practice.
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 practical lessons in laboratory. Private study: 90 hours *(self-study)*.
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Introduction to programming, Visual C programming
Module objectives/intended learning outcomes	Present several basic knowledges of the data structure and algorithms, how to re-perform data according to problem purposes. Two basic methods of searching and eleven arrangements algorithms are presented in the second part. Chapter Three and Four will present the basic data structures. *Specific objectives / course learning outcomes:* • Knowledge: Clearly understanding algorithms, search methods, arrangements, and dynamic data structures • Skills: analyzing algorithms, generalize data, algorithm settings • Attitudes, specialized: have attitudes, views, and proper perception of subjects
Content	Introduction of algorithms, analyzing the algorithms and generalizing data. Search methods and arrangement in arrays. Basic dynamic data structure: single and double linked lists, binary search trees.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.

Reading list	1. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, 1997. 2. Nhập môn cấu trúc dữ liệu và thuật toán, Trần Hạnh Nhi, Dương Anh Đức, 2003. 3. Data structures and C programs, Christopher J Van Wyk, 1990.

6. Discrete Mathematics - MTH10406

Module designation	Discrete Mathematics
Semester(s) in which the module is taught	4th semester
Person responsible for the module	Dr. Le Van Hop – Department of Algebra
Language	Vietnamese
Relation to curriculum	Optional
Teaching methods	lecture, exercise
Workload (incl. contact hours, self-study hours)	Total: 165 hours Contact hours: lecture 45 hours + 30 exercise hours Private study: 90 hours *(self-study).*
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Introduction to computer programming
Module objectives/intended learning outcomes	General objectives: providing basic knowledge for information technology students. Specific objectives / course learning outcome: Knowledge: Mastering logical issues, set- mapping, relations on sets. Skills: Strict and accurate presentation of professional issues, good implementation of counting problems, solution of recursion, integer algorithms, solving equations on Zn, minimal polynomial algorithms for Boole functions. Attitude, diligence: serious and positive learning, participating in discussions, asking questions, and responding to comments, completing the lecturers' learning requirements.
Content	The subject is within scientific knowledge. It provides very necessary knowledge (about logic, discrete structures, related algorithms, ...) for information technology students. This knowledge supports a lot for students to absorb their grassroots and specialized subjects.
Examination forms	Midterm and final exam: written exams.

Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Bài giảng Toán rời rạc, Lê Văn Hợp 2. Toán rời rạc, Nguyễn Hữu Anh, 1999 3. Discrete Mathematics and Its Application, Kenneth H. Rosen, 2012. 4. Discrete Mathematics, Richard Johnsonbaugh, 2005 5. Méthodes Mathématiques Pour L'informatique, Jacques Vélu, 2005.

7. Object Oriented Programming - MTH10407

Module designation	Object Oriented Programming
Semester(s) in which the module is taught	4th semester
Person responsible for the module	MSc. Nguyễn Ngọc Long
Language	Vietnamese
Relation to curriculum	Optional
Teaching methods	The document provides students at the first session including: summary lectures, lectures with slides, references. Students attend theoretical lectures and practice, participate in discussion, self-study, and major assignments.
Workload (incl. contact hours, self-study hours)	lecture, lab work
Credit points	Total: 165 hours Contact hours: lecture 45 hours + 30 exercise hours Private study: 90 hours *(self-study)*.
Required and recommended prerequisites for joining the module	Data structure and Algorithm, Introduction to computer programming
Module objectives/intended learning outcomes	Introducing to students the basic principles of object-oriented methodology and object-oriented programming techniques as a basis for building later applications.
Content	The principles of object-oriented methodology. The principles for building object classes, data identification and manipulation, establishing relations between classes, especially inheritance relation and polymorphism. Design, build classes, definition operations and operations in C ++. Install specific relations between layers, inheritance, polymorphism in C ++.
Examination forms	Midterm and final exam: written exams/major assignment

Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Bjarne Stroustrup, ***The C++ programming language***, 3rd Edition, AT&T, 1997. 2. James O. Coplien, ***Advanced C++ Programming Styles and Idioms***, Addison-Wesley Longman, 1991. 3. Scott Robert Ladd, ***C++ Kỹ Thuật và Ứng Dụng***, NXB Khoa Học Kỹ Thuật, 1992. 4. J Rumbaugh, M Blaha, W Premerlani, F Eddy, W Lorensen, ***Object-Oriented Modeling and Design***, Prentice Hall, 1991.

8. Methods of teaching Mathematics 1 - MTH10110

Module designation	Methods of Teaching Mathematics I
Semester(s) in which the module is taught	Both 5st and 6st semester
Person responsible for the module	Dr. Ta Thi Nguyet Nga,
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, project-based learning, think pair share
Workload (incl. contact hours, self-study hours)	120 Hours Contact hours: Lectures 30 hour + 30 practical lessons *(in class)* Private study: 60 hours *(self-study)*
Credit points	3 Credits / 5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	**General objectives:** Presenting basic scientific knowledge; The foundation knowledge of mathematics and high school mathematics methods, education and theory of teaching, ages pedagogical psychology, teaching methods, class control and evaluation organizations Recognizing the close relationship between the theoretical bases learned, the theory with reality problems. Recognize the powers and privileges of society for teachers as well as teachers' responsibility to help learners benefit themselves, communities, and the environment. Application of professional knowledge to address the requirements set out in learning as well as practical issues in the future.

	Choose flexible high school math methods, teaching and evaluation methods, interactive skills & class controls, modern tools to teach with the spirit of learning learners as a center. Develop logical thinking, thinking thinking, creative thinking and problem-solving capacities. Identity is the role and responsibility of learners and future teachers. **Specific objectives /learning outcome:** **Knowledge:** Overview of Algebraic Knowledge Identify issues in teaching recently. Describe math teaching methods. **Skills:** Select the appropriate theoretical basis to solve the corresponding exercises. Actively help learners understand the value of learning, on that basis to benefit themselves, communities, and the environment Application of arithmetic and logical knowledge in the process of developing mathematical thinking for students Applying fundamental mathematical knowledge into practice Choose advanced math knowledge to solve practical problems. Select the appropriate tools to teach math. Forming a new teaching idea suitable for each student object **Attitude, specialist:** Improve the professional ethics
Content	The course refers to the issues of statements, sets, functions, equations, algebraic inequality, limits, continuous functions, and derivative of functions
Examination forms	Writing
Study and examination requirements	Mid-term: 40 % Final exam: 60 %
Reading list	1. Đại số lớp 10, Đoàn Quỳnh, Nguyễn Huy Đoan, Nguyễn Xuân Liêm, Đặng Hùng Thắng, Trần Văn Vuông, 2006. 2. Đại số và Giải tích lớp 11, Đoàn Quỳnh, Nguyễn Huy Đoan, Nguyễn Xuân Liêm, Nguyễn Khắc Minh, Đặng Hùng Thắng, 2006. 3. Thực hành giải toán sơ cấp tập 1, E. E. Veresova, N. S. Denisova, T. N. Poliakova, Người dịch: Hoàng Thị Thanh Liêm, Nguyễn Thị Ninh, Nguyễn Văn Quyết, Vũ Thụ, 1986.

9. Methods of teaching Mathematics 2 - MTH10111

Module designation	Methods of Teaching Mathematics II
Semester(s) in which the module is taught	Both 5st and 6st semester
Person responsible for the module	Dr. Ta Thi Nguyet Nga,
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, project-based learning, think pair share
Workload (incl. contact hours, self-study hours)	120 Hours Contact hours: Lectures 30 hour + 30 practical lessons *(in class)* Private study: 60 hours *(self-study)*
Credit points	3 Credits / 5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	The course equips students with vocabulary, mathematical concepts, and crucial structures in English. It also provides learners with positive teaching methods, important considerations for teaching mathematics in English, curriculum, and lesson plan development. - Knowledge: Mastering the vocabulary and structures in Mathematics in Engling, applying positive method in teaching mathematics in English. - Skills & competences: cognitive and practical abilities to use these knowledges in teaching mathematics.
Content	This module includes the following topics: 1. Teaching Arithmetic and Algbra 2. Teaching Geometry 3. Teaching Calculus Teaching Probablilites and statistics
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 1. Glencoe, *Advanced Mathematical Concepts Precalculus with Applications,* McGraw-Hill, 2021. 2. Daniel J. Brahier *Teaching Secondary and Middle School Mathematics* Routledge, 2016.

2.2. Foundation in Concentration by Specialization

2.2.1. Specialization in Mechanics

1. Numerical Analysis 1 - MTH10410

Module designation	Numerical Analysis 1
Semester(s) in which the module is taught	4th semester
Person responsible for the module	Dr. Ông Thanh Hải, Department of Analysis
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures, lab works
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 practical lessons in laboratory. Private study: 90 hours *(self-study)*.
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Calculus 1A, Calculus 2A, Computational Softwares Laboratory
Module objectives/intended learning outcomes	**General Objective:** To introduce the basic concepts and approximation methods of numerical analysis, and to provide students with the tools to find approximate solutions to problems involving equations and systems of equations. By finding algorithms to solve the problems posed, this module aims to equip students with knowledge to solve real problems based on theoretical math knowledge and the means of computations. The course helps students to understand the following knowledge: understand the concept of approximation and types of errors. Understand the most basic approximation methods and their applications. Application of computational software in numerical calculations.
Content	The content of the course includes in the approximate theories and their application to find the approximate solutions of the single variable equations and the system of linear equations, and the approximate derivative, integral... These methods which are applied into the physical problems, are used the Matlab program to simulate.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	Exam: 30%, Final Exam: 70%. + Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Numerical Analysis. Ninth Edition. Brooks, Burden and Faires, 2010. 2. Numerical Analysis. Pearson, Sauer, 2006. 3. Numerical Analysis. Brooks/Cole Publishing Company, Kincaid, W. Cheney, 1991. 4. Numerical methods using Matlab. Third Edition. Prentice Hall, J. H. Mathews, K. D. Frink, 1999

2. Equations of Mathematical Physics - MTH10413

Module designation	Equations Of Mathematical Physics
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Nguyễn Thành Long
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	Total: 150 hours Contact hours: lectures 60 hours *(in-class)*. Private study: 90 hours *(self-study)*.
Credit points	4 credits / 6.0 ECTS
Required and recommended prerequisites for joining the module	Calculus 1A, Calculus 2A, Analysis 1A
Module objectives/intended learning outcomes	Introduce the basic mathematical physics equations and know how to find classical solutions by Fourier's method of separation of variables.
Content	Linear ordinary differential equations of the second order. Wave equations; Heat equations; Laplace equations.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	Midterm Exam: 30%, Final Exam: 70% + Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Bài giảng phương trình toán lý, Nguyễn Thành Long, 2020. 2. Phương Trình Vật lý - Toán nâng cao, Nguyễn Công Tâm, 2002. 3. Partial Differential Equations, An introduction, David Colton, 1988. 4. Partial Differential Equations, L.C. Evans, 1998. 5. Fundamentals of differential equations and boundary value problems, R. Kent Nagle, Edward B. Saff, 1993.

3. Theoretical Mechanics - MTH10427

Module designation	Theoretical mechanics
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Dr. Trịnh Anh Ngọc, Department of Machenics
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	Total: 150 hours Contact hours: lectures 60 hours *(in-class)*. Private study: 90 hours *(self-study)*.
Credit points	4 credits / 6.0 ECTS
Required and recommended prerequisites for joining the module	Knowing calculus and linear algebra.
Module objectives/intended learning outcomes	General Objective: To provide basic knowledge of Newtonian mechanics. Help students know how to set and solve basic mechanical problems. Know how to analyze and explain mechanical phenomena based on Newton's laws. The course introduces mathematical modeling of real-world processes. Specific objectives/course learning outcomes: ● Knowledge: Newton's laws and their consequences. ● Know how to build mathematical models describing mechanical phenomena. Know how to solve some mechanical problems. ● Attitude, diligence: Positive and dynamic.
Content	This module includes the following topics: 1. Vectors 2. Mechanics of a Particles 3. Mechanics of Particle Systems 4. Mechanics of Connected Systems
Examination forms	Writing
Study and examination requirements	Tests – process score: 40%; Final exam: 60 % + Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Bài giảng Cơ học lý thuyết, Trịnh Anh Ngọc, 2018. 2. Nhập môn cơ học, Đặng Đình Áng, Trịnh Anh Ngọc, Ngô Thành Phong, 2003. 3. Classical Mechanics, Douglas Gregory, 2006. 4. Classical Mechanics Solutions manual, Douglas Gregory, 2006.

4. Continuum Mechanics - MTH10428

Module designation	Continuum mechanics
Semester(s) in which the module is taught	6th semsester
Person responsible for the module	Dr. Bùi Xuân Thắng, Department of Machenics
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	Total workload = 180 hours. Contact hours: 60 hours. self-study hours: 120 hours.
Credit points	4 credits/ 6.0 ETCS
Required and recommended prerequisites for joining the module	Knowing calculus and linear algebra.
Module objectives/intended learning outcomes	General Objective: To provide students with fundamental knowledge of continuums in mechanics and mathematical modeling for continuums. Introduce students to in-depth research directions on continuous environmental objects: Deformed solids, Fluids. Specific objectives/course output standards: Knowledge: Understand the concept of continuum, the laws of physics. Apply concepts and laws to mathematically model continuum. Skills: Apply concepts and laws to mathematically model continuums such as elastic solid bodies, fluids. Attitude, diligence: After the course, students will understand and be interested in the direction of mathematical research in continuum mechanics.
Content	This course introduces and provides the foundation knowledge for the modules of Deformed Solid Mechanics, Fluid Mechanics, Fracture Mechanics, Composite Materials, and Mechanics Seminar. - Analysis of stress - Deformation and strain - Motion and flow - Fundamental laws of continuum mechanics - Linear elasticity - Fluids
Examination forms	Essay exam
Study and examination requirements	Tests – process score: 35%; Final exam: 65 % + Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Continuum Mechanics, George E. Mase, 1970 2. Cơ học môi trường liên tục, Đào Huy Bích, 2002

5. Finite Element Method - MTH10429

Module designation	Finite Element Method
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Dr. Vu Do Huy Cuong
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures, group work
Workload (incl. contact hours, self-study hours)	Total: 165 hours Contact hours: Lectures 45 hour + 30 lab works hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	Recommended prerequisites: Programing Matlab.
Module objectives/intended learning outcomes	General Objective: To provide basic knowledge of the finite element method. Help students know how to apply the finite element method to solve boundary problems, boundary-value problems appearing in mechanics and physics. Specific objectives/course learning outcomes: • Knowledge: Master the concepts and procedures in the finite element method • Skills: Know how to apply finite element method to numerically solve boundary problems, boundary-first value problems (from finite element discretization to Matlab programming) • Attitude, diligence: Positive and dynamic.
Content	This module includes the following topics: 1. Introduction to numerical methods and finite element methods. 2. Application of the finite element method to scientific and engineering problems. 3. Fundamental theory of the finite element method. 4. Finite element for partial differential equations. 5. Finite element for elasticity theory.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures). Final score is greater or equal to 5.0/10.0.
Reading list	- Main text book: 1. Bài giảng Phương pháp phần tử hữu hạn, Trịnh Anh Ngọc, lecture note, 2018. - References: 2. Finite element Analysis, Flaherty J.E., lecture note, 2000. 3. The finite element method in engineering, Rao S.S., Elsevier Inc, 1989.

6. Complex variable functions - MTH10412

Module designation	Complex Variable Functions
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Assoc. Prof. Lý Kim Hà
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	Total: 150 hours Contact hours: lectures 60 hours *(in-class)*. Private study: 90 hours *(self-study)*.
Credit points	4 credits/ 6.0 ETCS
Required and recommended prerequisites for joining the module	Compulsory courses in Analysis, from Analysis 1 to Analysis 4
Module objectives/intended learning outcomes	Equip with basic knowledge of complex numbers, elementary complex functions, and necessary complex analysis knowledge to be able to apply in the specializations of numerical analysis, partial differential equations, digital signal processing, statistics, and probability.
Content	Basis properties of complex numbers and complex functions. Analytic functions, the power expansion, line integral and the theory of residues.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	Midterm Exam: 30%, Final Exam: 70%.
Reading list	1. Complex analysis, Theodore Gamelin, 2001. 2. Complex variables with applications, David Wunsch, 2005. 3. Complex analysis, V. Ahlfors, 1966. 4. Théorie élémentaire des fonctions analytiques d'une ou plusieurs variables complexes, Henri Cartan, 1961.

7. Solids Mechanics - MTH10434

Module designation	Solid Mechanics
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Dr. Bùi Xuân Thắng
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	Total workload = 180 hours. Contact hours: 60 hours (in class). Self-study hours: 120 hours.
Credit points	4 credits/ 6 ETCS
Required and recommended	Continuum Mechanics

prerequisites for joining the module	
Module objectives/intended learning outcomes	General Objective: To provide students with basic concepts of the laws of behavior of solid bodies. Present some basic laws and theorems related to many practical problems of Deformed Solid Mechanics. Provide students with methods of modelling, solving problems and numerical simulation by computers. Specific objectives/course output standards: Knowledge: Students understand the basic concepts of the laws of behavior of solid bodies. Students develop methods of modeling, solving problems and numerical simulation by computers.
Content	The subject plays an important role in providing basic knowledge and opening in-depth research directions in the Deformed Solid Mechanics. The basic knowledge that can be mentioned is the stress-strain relationship in elastic, viscoelastic and elastoplastic theories... In-depth research directions that can be mentioned are the analysis of the behavior of the plate, shell, composite materials, fracture mechanics... This subject inherits a lot of knowledge from the subject of Continuum Mechanics and is also a prerequisite for Finite Element Method, Fracture Mechanics, and Stability and Vibration… - Linear elastic solids - Formulation and solution strategies - Strain energy and related principles - Two-dimentional formulation and problem solution - Anisotropic elasticity - Thermoelasticity - Nonhomogeneous elasticity - Numerical finite element method - An introduction of plasticity.
Examination forms	Report/Essay exam
Study and examination requirements	Tests – process score: 35% Final exam: 65 %
Reading list	1. Lý thuyết đàn hồi, Đào Xuân Bích, 2010. 2. Elasticity, M. H. Sadd, 2009. 3. Cơ học môi trường liên tục, Xêđôp L. I., 1978. 4. Nonlinear analysis and continuum mechanics, Giuseppe Buttazzo, 1998.

8. Fluid Mechanics - MTH10435

Module designation	Fluid mechanics
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Dr. Nguyen Thi Yen Ngoc
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	Total: 150 Hours Contact hours: Lectures: 60 hour *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Recommended prerequisites: Theoretical mechanics
Module objectives/intended learning outcomes	This course provides fundamental knowledge on fluid mechanics. - Knowledge: understanding the fundamental concepts and basic laws of fluid mechanics. - Skills & competences: cognitive and practical abilities to use these knowledges in analyzing the physical and mathematical meaning of fluid mechanics problems and solving some basic problems in certain cases.
Content	This module includes the following topics: 1. Introduction 2. Fluid statics 3. Conservation of mass 4. Inviscid flow 5. Conservation of momentum 6. Viscous flow 7. Conservation of energy
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 1. Trịnh Anh Ngọc, *Bài giảng "Cơ học chất lỏng lý thuyết"*, 2018. References: 1. Munson, Young, Okiishi, and Huebsch, *Fundamentals of Fluid Mechanics*, Wiley, 2009. 2. Fay J.A., *Introduction to fluid mechanics*, MIT Press, 1998. 3. I.G. Currie, *Fundamental Mechanics of Fluids*, CRC Press, 2012.

9. Mechanics seminar - MTH10520

Module designation	Seminar of Mechanics
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Dr Vũ Đỗ Huy Cường, Dr Bùi Xuân Thắng, Dr Nguyễn Thị Yến Ngọc, MSc Lê Văn Chánh
Language	Vietnamese
Relation to curriculum	Optional
Teaching methods	Project, seminar
Workload (incl. contact hours, self-study hours)	Total workload: 210 hours. Contact hours: 90 hours. Private study including examination preparation, specified inhours: 120 hours.
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Successfully completed 124/134 credits
Module objectives/intended learning outcomes	After completing the course, students will be able to: • **Apply mathematical principles to solve real-world engineering problems.** This includes using calculus, linear algebra, differential equations, and other mathematical tools to analyze forces, stresses, strains, heat transfer, fluid flow, and other physical phenomena. • **Develop and use computational models to simulate mechanical systems.** This involves using software to create virtual models of machines, structures, and other systems, and then running simulations to predict their behavior under different conditions. • **Design and analyze mechanical systems.** This involves applying the principles of mechanics, materials science, and thermodynamics to create new machines, devices, and structures. • Present and defend results of the project at the Students' Seminar Conference.
Content	Various topics
Examination forms	Essay, oral presentation
Study and examination requirements	Minimum attendance at weekly meeting is 80%. Final defense is required. Final score is greater or equal to 5.0/10.0
Reading list	Diverse documents and depends on the instructor.

10. Finite difference methods - MTH10521

Module designation	Finite Difference Methods
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Dr. Ong Thanh Hai, Department of Analysis
Language	Vietnamese
Relation to curriculum	Optional
Teaching methods	lectures
Workload (incl. contact hours, self-study hours)	Total: 90 hours Contact hours: 30 hour *(in class)* Private study: 60 hours *(self-study)*
Credit points	2 credits/ 3 ETCS
Required and recommended prerequisites for joining the module	MATLAB, Functional analysis, Linear Algebra.
Module objectives/intended learning outcomes	General objectives: The module provides students with an overview of numerical analysis applied in industrial problems. This subject can be considered as a premise for students to get acquainted with mathematical models, numerical analysis, and computational science. Moreover, the course is considered as a complement to two important subjects of the major of numerical analysis: finite volume methods and finite element method.
Content	Partial differential equations are a main part of industrial problems. However, it is not easy to solve these problems. This course introduces to students' basic steps of numerical schemes to solve industrial problems from discretizing the simple partial differential equations such as: heat equation or diffusion equation. The key to the course includes two parts: theory and practice.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Finite Difference Schemes and Partial Differential Equations, J. C. Strikwerda, 1989. 2. Finite Difference Methods for Ordinary and Partial Differential Equations, R. J. LeVeque, 2007.

	3. Numerical Solution of Partial Differential Equations, K. W. Morton, and D. F. Mayers, 1995

12. Dynamics of multibody and Robotics - MTH10524

Module designation	Dynamics of Multibody Systems and Robotics
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Dr. Nguyen Thi Yen Ngoc
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lectures, lab works
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: Lectures 45 hour + 30 lab works hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Recommended prerequisites: Theoretical mechanics
Module objectives/intended learning outcomes	This course provides fundamental knowledge on kinematics and dynamics of multibody systems. - Knowledge: understanding the principles, laws of Newtonian mechanics, and the equations of motion of multibody systems. - Skills & competences: cognitive and practical abilities to use these knowledges in analyzing and solving multibody problems, e.g. robot hand.
Content	This module includes the following topics: 1. Particle dynamics and rigid-body kinematics 2. Robot 3. Kinematics for general multibody systems 4. Modeling of forces in multibody systems 5. Equations of motion of multibody systems
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.

Reading list	Main textbook: 1. Farid M. L. Amirouche, *Fundamentals of multibody dynamics*, Birkhäuser Basel, 2006. References: 2. Ngô Thành Phong, *Theoretical mechanics*, NXB ĐHQG TP.HCM, 2016. 3. Jens Wittenburg, *Dynamics of Multibody Systems*, Springer, 2008. 4. Jorge Angeles, *Fundamentals of Robotic Mechanical Systems*, Springer, 2018.

13. Random vibration - MTH10526

Module designation	Random Vibration
Semester(s) in which the module is taught	8th semester
Person responsible for the module	MSc. Le Van Chanh
Language	Vietnamese
Relation to curriculum	Specialisation
Teaching methods	Lectures, group work
Workload (incl. contact hours, self-study hours)	150 hours Contact hours: Lectures 60 hour *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Knowing probability theory
Module objectives/intended learning outcomes	General Objective: To provide basic knowledge of the random vibration. Help students know how to apply the random vibration theory to solve real-world problems. Specific objectives/course learning outcomes: •Knowledge: Master the fundamental concepts of probability theory and random oscillations • Skills: Applying knowledge of random oscillations to solve real-world problems. • Attitude, diligence: Positive and dynamic
Content	This module includes the following topics: 1. Introduction to probability theory and random vibration 2. Random Vibrations of a sdof oscillations 3. Random Vibrations of higher order systems 4. Infinite dof oscillatory systems
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Final score is greater or equal to 5.0/10.0

Reading list	- Main textbook: 1. Krée, Paul, and Christian Soize. Mathematics of random phenomena: random vibrations of mechanical structures. Vol. 32. Springer Science & Business Media, 2012. - References: 2. Giuseppe Buttazzo, Nonlinear analysis and continuum mechanics, Springer-Verlag, 1998 3. Nguyễn Đông Anh, Lã Đức Việt, Giảm dao động bằng thiết bị tiêu tán năng lượng, Khoa học Tự nhiên và Công nghệ, 2007.

2.2.2. Specialization in Algebra

1. Homological Algebra - MTH10418

Module designation	Homological Algebra
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Dr. Nguyễn Văn Thìn (A)
Language	Vietnamese
Relation to curriculum	Compulsory in an elective list
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	Total: 150 hours Contact hours: Lectures 60 hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Prerequisite course: Higher Algebra
Module objectives/intended learning outcomes	General objective: To equip students with basic knowledge of Homological Algebra, help students to use their tools in research and study topics on Groups, Commutative Algebra, Algebraic Topology. Specific objectives/ course learning outcomes: Knowledge: Understand the functors Hom, Tensor, Tor, Ext. Skills: Solve basic problems of Hom, Tensor, Tor, Ext functors Attitude, diligence: Actively participate in classwork.
Content	The course introduces the basic concepts of homology algebra, focusing on four functors in algebra: Hom, Tensor, Tor, and Ext and the singular homology of topological spaces.
Examination forms	Essay exam
Study and examination requirements	Tests – process score: 30% Final exam: 70%
Reading list	1. Đại số đồng điều, Nguyễn Viết Đông, Trần Huyên, 2006. 2. Homological Algebra, Cartan, H and Eilenberg, S, 1956. 3. Homology, Mac Lane,1963. 4. Homotopy theory, Hu Sze-Tsen, 1959.

2. Commutative Algebra - MTH10419

Module designation	Commutative Algebra
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Dr. Trần Ngọc Hội
Language	Vietnamese
Relation to curriculum	Compulsory in an elective list
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	Total: 150 hours Contact hours: Lectures 60 hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Prerequisite subjects: Higher Algebra Course requirements: Mastery of basic algebraic structures such as groups, rings, integral domains, and fields.
Module objectives/intended learning outcomes	General Objective: To equip students with higher knowledge of commutative rings, the foundation for the study of algebraic geometry and algebraic number theory. Specific objectives/course learning outcomes: Knowledge: Mastery of primary decomposition in commutative Noetherian rings, quotient rings, chain conditions on modules, Noetherian and Artinian rings, ring extension. Skills: Improve reasoning and computation in commutative rings. Attitude, diligence: Serious, dynamic, and progressive.
Content	To introduce further properties of commutative rings such as primary decomposition, quotient rings, chain conditions of modules, Noetherian and Artinian rings, ring extension.
Examination forms	Essay exam
Study and examination requirements	Tests – process score: 50% Final exam: 50%
Reading list	1. A Course in Commutative Algebra, Ash, R. B., 2003. 2. Steps in Commutative Algebra, Sharp, R. I., 2000. 3. Introduction to Commutative Algebra, Atiyah, M. F. and Macdonald, I. G., 1969. 4. Commutative Ring Theory, Matsumura, H., 1986.

3. Introduction to ring theory - MTH10420

Module designation	Introduction To Ring Theory
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Nguyễn Văn Thìn (A)
Language	Vietnamese
Relation to curriculum	Compulsory in an elective list
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	Total: 150 hours Contact hours: Lectures 60 hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Prerequisite course: Higher Algebra
Module objectives/intended learning outcomes	General Objective: To equip students with basic knowledge of ring theory and Module theory. Specific objectives/course learning outcomes: Knowledge: Understand the concepts of prime, semi-prime, local rings, commutative semi-locals, localization, chain conditions on modules, Jordan-Holder theorem. Skills: Solve basic problems of prime rings, semiprime rings, local rings, commutative semi-locals, localization, chain conditions on modules. Attitude, diligence: Serious, dynamic, and progressive.
Content	The course introduces the basic concepts of ring theory and Module theory. Focus on introducing the concepts of direct sums and products, prime rings, semi-prime, local rings, commutative semi-locals, quotient ring of a commutative ring. Introduce the chain conditions on modules, free modules, and projective modules.
Examination forms	Essay exam
Study and examination requirements	Tests – process score: 30% Final exam: 70%
Reading list	1. Nhập Môn Lý Thuyết Vành và Môđun, Nguyễn Văn Thìn, 2012. 2. Algebra, Hungerford Thomas W., 1974. 3. Algebra: Vol II: Rings, Luthar I.S. , Passi I.B.S., 2002. 4. Algebra: Vol III : Modules, Luthar I.S. , Passi I.B.S., 2002.

4. Modern algebra - MTH10421

Module designation	Modern Algebra
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Prof. Bùi Xuân Hải
Language	Vietnamese
Relation to curriculum	Compulsory in an elective list
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	Total: 150 hours Contact hours: Lectures 60 hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Prerequisite course: Algebra
Module objectives/intended learning outcomes	The goal of the course is to equip students with deeper knowledge of basic algebraic structures
Content	The course includes the following two sections: Group theory: group isomorphism theorems; Sylow's theorems on finite groups; the free Abel groups; solvable groups and nilpotent groups. Ring theory: ring isomorphism theorems; some finite conditions; polynomial rings on commutative rings; PID, UFD and Dedekind integral domains.
Examination forms	Essay exam
Study and examination requirements	Tests – process score: 30% Final exam: 70%
Reading list	1. Bùi Xuân Hải (Chủ biên), Trịnh Thanh Đèo, *Đại số hiện đại*, NXB ĐHQG Tp. Hồ Chí Minh 2002. 2. Joseph J. Rotman, *An Introduction to the Theory of Groups*, Four Edition, Springer- Verlag, 1994. 3. S. Lang, *Algebra,* Addison-Wesley Publishing Company, 1965. 4. Algebra : Vol III : Modules, Luthar I.S. , Passi I.B.S., 2002

5. Fields and Galois Theory - MTH10422

Module designation	Fields and Galois Theory
Semester(s) in which the module is taught	7the semester
Person responsible for the module	Prof. Bùi Xuân Hải
Language	Vietnamese
Relation to curriculum	Compulsory in an elective list
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	Total: 150 hours Contact hours: Lectures 60 hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Prerequisite courses: Higher Algebra, Modern Algebra Course requirements: Mastery of basic algebraic structures such as groups, rings, and fields.
Module objectives/intended learning outcomes	General Objective: To introduce the theory of field extension and basic ideas of Galois theory. Specific objectives/course learning outcomes: Knowledge: finite extensions, algebraic extensions, splitting fields, normal extensions, separable extensions, Galois correspondence..., basic ideas of Galois theory leading to Galois fundamental theorem and its application in proving the fundamental theorem of algebra and many other applications; conditions for an algebraic equation to be solved by radicals. Skill: Finding Galois groups of the finite extensions; describing the intermediate subfields; computing Galois group of a polynomial. Attitude, diligence: Fully participate in class sessions; discussions outside class time.
Content	This course aims to equip the foundation knowledge of field extension theory; Galois correspondences; application of Galois theory to various problems of modern mathematics.
Examination forms	Essay exam
Study and examination requirements	Tests – process score: 30% Final exam: 70%
Reading list	1. Trường và Lý thuyết Galois, Bùi Xuân Hải, 2013. 2. Lý thuyết Galois, Ngô Việt Trung, 2005 3. Đại số hiện đại, Bùi Xuân Hải (chủ biên), Trịnh Thanh Đèo, 2013.

6. Algebraic Topology - MTH10492

Module designation	Algebraic Topology
Semester(s) in which the module is taught	6th, 8th semester
Person responsible for the module	Dr. Huỳnh Quang Vũ
Language	Vietnamese
Relation to curriculum	Specialized, elective
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 120 hours. Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 60 hours. Private study including examination preparation, specified in hours: 60 hours.
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Analysis 1, 2, 3 (required); Topology (recommended)
Module objectives/intended learning outcomes	This course is designed to help students to grasp fundamental notions, methods, and results of beginning combinatorial and algebraic topology. The course focuses on discussing important and representative examples. Certain fundamental but difficult to prove results, such as equivalence among homologies, will be assumed. The course foremostly benefits students interested in theoretical mathematics. Recently certain aspects of algebraic topology have been applied to Computer Science, so students interested in Computer Science might also find this course beneficial. Specific objectives/course learning outcomes: • Knowledge: The students should be able to demonstrate understanding of key concepts and results. • Skills: able to compute in concrete cases and to form mathematical arguments. Analyze facts, arguments, and proofs. Study and present small topics not covered in class. • Attitude, diligence: a serious, proactive, and self-disciplined learning attitude.
Content	Basic combinatorial and algebraic topology: simplicial complex, cell complex, homotopy, fundamental group, simplicial homology, cell homology.
Examination forms	Assignments 60%; Final exam 40% (written, in-class, problem-solving)
Study and examination requirements	Minimum class attendance: 80% Minimum class grade: 50%

Reading list	[1] Huỳnh Quang Vũ, Lecture notes on Topology, https://sites.google.com/view/hqvu/teaching Reference: [1] Fred H. Croom, Basic concepts of algebraic topology, Springer-Verlag, 1978. [2] M. A. Amstrong, Basic topology, Springer, 1983. [3] Klaus Jänich, Topology, Undergraduate Texts in Mathematics, Springer-Verlag, 1984. [4] James Munkres, Topology a first course, 2nd ed., Prentice-Hall, 2000. [5] Hatcher, Allen, Algebraic Topology, Cambridge, 2001.

7. Group theory - MTH10596

Module designation	Group Theory
Semester(s) in which the module is taught	7the semester
Person responsible for the module	Dr. Nguyen Van Thin (A)
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lectures, small group solving exercises
Workload (incl. contact hours, self-study hours)	150 Hours Contact hours: Lectures 60 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Modern Algebra
Module objectives/intended learning outcomes	- General objectives: This course aims to provide students with some advanced knowledge about the theory of P-groups, P-subgroups Sylow, groups satisfying normalization conditions, solvable groups, nilpotent groups, M-groups, supersolvable groups be and the Fratini subgroup. - Specific objectives/course learning outcomes: • Knowledge: Mastering the knowledge of P-groups, Sylow P-subgroups, Solvable groups, Nilpotent groups, M-groups, Supersolvable groups and Fratini subgroups. • Skills: Solving advanced problems of P-groups, Sylow P-subgroups, Nilpotent groups, M-groups, Solvable supergroups, and Fratini subgroups. • Attitude: Attend all classroom sessions and discussions outside of class time.
Content	This module includes the following topics: 1. Sylow P-Subgroups

	2. P-Groups and Nilpotent Groups 3. M-Groups 4. Supersolvable Groups 5. Fratini subgroups
Examination forms	Class discussion; quizzes: Mid-term and Final exam: Written exam (closed - book).
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Final score is greater or equal to 5.0/10.0
Reading list	- Main book 1. W. R. Scott, Group Theory, Dover Publications, INC. New York, 1987. - References: 2. Bùi Xuân Hải & Trịnh Thanh Đèo, Đại Số Hiện Đại, Ho Chi Minh City National University, 2002. 3. Jhon S. Rose, A Coure on Group Theory, The University Printing House, Cambridge, 1970.

8. Representation theory of finite groups - MTH10497

Module designation	Representation theory of finite groups
Semester(s) in which the module is taught	6th semester, 8th semester
Person responsible for the module	Dr Nguyen Khanh Tung
Language	English
Relation to curriculum	Elective
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	Total: 145 Hours Lectures: 45 hours (in class) Class exercises: 15 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Master basic algebraic structures such as groups, rings, integer domains, and fields.
Module objectives/intended learning outcomes	- General objective: Introduce the theory of finite group representation as a tool for studying finite groups. - Specific objectives/course learning outcomes: • Knowledge: Master the representation of finite groups, characteristics, and characters theory. • Skills: Enhance the ability to infer and compute in abstract group settings. • Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics:

	1. Basic concepts of group representation 2. Characters of a group representation 3. Characters 4. Induced modules and characters 5. Applications to group theory
Examination forms	Class discussion; quizzes: Mid-term and Final exam: Written exam (closed - book).
Study and examination requirements	Continuous assessment: accounts for 50%, including: • Regular quizzes: 20%. • Discussions, exercises, practical work: 40%. • Mid-term exam: 40%. Final exam: accounts for 50%, including: • Theory exam: 100%. • Format of the final exam: Written exam (closed - book).
Reading list	- Main book **Representations and Characters of Groups,** Gordon James and Martin Liebeck. - References: 1. **Representations and Characters of Finite Groups**, Collins, M. J. 2. **Representations of Finite Groups**, Baker Andrew. 3. **Notes on the Representations of Finite Group**, Jacson, D. M.

9. Introduction to the Number Theory - MTH10498

Module designation	Introduction to the Number Theory
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Prof. Dr Bui Xuan Hai
Language	English
Relation to curriculum	Elective
Teaching methods	Lectures, group work, small group for project.
Workload (incl. contact hours, self-study hours)	120 Hours Contact hours: Lectures: 60 hours (in class) Private study: 60 hours (self-study)
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- General objectives: This course aims to provide students with some knowledge about classical arithmetic. - Specific objectives/course learning outcomes:

	• Knowledge: Master the knowledge of some arithmetic functions such as Euler function, Mobious function; and first- and second-order congruent equations. • Skills: Applying arithmetic functions to solve some arithmetic problems; knowing how to solve some first- and second-order congruent equations. • Attitude: Attend all classroom sessions and discussions outside of class time.
Content	This module includes the following topics: 1. Divisibility Theory 2. Important Number-Theoretical Functions. 3. Congruences In One Unknown 4. Congruences Of Second Degree
Examination forms	Class discussion; quizzes: Mid-term and Final exam: Written exam and homework.
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Final score is greater or equal to 5.0/10.0
Reading list	- Main book: 1.**Basic of Number Theory**, I.M. Vinogradov. - References: 1.**Introduction to Analytic Number Theory,** K. Chandrasekharan. 2.**Linear Algebra,** Victor Shoup.

10. Finite fields - MTH10499

Module designation	Finite Fields
Semester(s) in which the module is taught	5th semester, 7th semester
Person responsible for the module	Dr Nguyen Khanh Tung
Language	English
Relation to curriculum	Elective
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	120 Hours Lectures: 45 hours (in class) Class exercises: 15 hours (in class) Private study: 60 hours (self-study)
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Basic Abstract Algebra

Module objectives/intended learning outcomes	- General objective: To equip students with basic knowledge of finite field theory and its applications in the theory of error-correcting codes and cryptography. - Specific objectives/course learning outcomes: • Knowledge: Master the fundamental knowledge of the structure of finite fields and their applications. • Skills: Assist students in developing the skills of inference and proof of mathematical theorems thoroughly and rigorously. • Attitude: Attend a minimum of 50% of the total class time for theory sessions. Complete at least 50% of the assigned exercises.
Content	This module includes the following topics: 1. Algebraic foundations: groups, rings and fileds. 2. Structure of finite fields. 3. Bases and polynomial bases. 4. Polynomials over finite fields.
Examination forms	Class discussion; quizzes; Final exam: Written exam (closed - book).
Study and examination requirements	Continuous assessment: accounts for 40%, including: • Exercise: 75%. • Attendance: 25%. Final exam: accounts for 60%, including: • Theory exam: 100%. • Format of the final exam: Written exam (closed - book).
Reading list	- Main book 1. **Introduction to Finite Fields and their Applications,** Lidl. R; Niederreiter. H. - References: 1. **Algebra,** Thomas. W. Hungerford. 2. **Finite Fields and Applications,** Garry L. Mullen, Carl Mummert.

11. Modules and their applications - MTH10500

Module designation	Modules and their applications
Semester(s) in which the module is taught	6th semester, 8th semester
Person responsible for the module	Dr. Nguyễn Khánh Tùng
Language	English
Relation to curriculum	Elective
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	120 Hours Lectures: 45 hours (in class) Class exercises: 15 hours (in class)

	Private study: 60 hours (self-study)
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Basic Abstract Algebra
Module objectives/intended learning outcomes	- General objective: To help students understand the relationship between module theory, linear algebra, and the theory of finitely generated abelian groups. - Specific objectives/course learning outcomes: Knowledge: Master the basic knowledge of modules and their applications in linear algebra, as well as the theory of finitely generated abelian groups. Skills: Enable students to infer and prove mathematical theorems thoroughly and rigorously. Attitude: Students must attend at least 50% of the class sessions and complete assigned exercises.
Content	This module includes the following topics: Basic knowledge of Modules and Rings 2. Structure theorem for finitely generated modules over a principal ideal domain. 3. Applications to the theory of finitely generated abelian groups. 4. Matrices and Canonical Forms.
Examination forms	Class discussion; quizzes: Mid-term and Final exam: Written exam (closed - book).
Study and examination requirements	Continuous assessment: accounts for 40%, including: • Exercise: 75%. • Attendance: 25%. Final exam: accounts for 60%, including: • Theory exam: 100%. • Format of the final exam: Written exam (closed - book).
Reading list	- Main book **Module theory: An approach to linear algebra,** T.S. Blyth. - References: **Algebra,** Thomas. W. Hungerford. **Rings and categories of modules,** Frank W. Anderson, Kent R. Fuller .

12. Algebra Seminar - MTH10501

Module designation	Algebra seminar
Semester(s) in which the module is taught	6th and 7th semester
Person responsible for the module	Assoc. Prof. Mai Hoàng Bien
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures, group work, small group for project.
Workload (incl. contact hours, self-study hours)	90 Hours Contact hours: Lectures: 90 hours (in class)

Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	This is an elective course. It is designed for students to acquire in-depth specialized knowledge in preparation for their graduation thesis. A student will work directly with an advisor on a weekly schedule agreed upon between the student and the advisor.
Content	According to each specific topics of advisors
Examination forms	Class discussion; quizzes: homework.
Study and examination requirements	A student will work directly with an advisor on a weekly schedule agreed upon between the student and the advisor.
Reading list	According to each specific topics of advisors

13. Graph theory - MTH10502

Module designation	Graph Theory
Semester(s) in which the module is taught	5th and 7th semester
Person responsible for the module	Dr. Nguyen Phuc Son
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	150 Hours Contact hours: Lectures: 60 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Discrete Mathematics
Module objectives/intended learning outcomes	- General objectives: This course will focus on classical problems and results in graph theory - Specific objectives/course learning outcomes: • Knowledge: isomorphism of graphs, paths, circuits, Eulerian graphs, Hamiltonian cycles, matrix representation of graphs, shortest path, trees, spanning trees in graphs • Skills: Understand algorithm to find the shortest spanning trees, shortest paths • Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics: 1. Paths, cycles, degrees 2. Special graphs 3. Connectivity 4. Eulerian and Hamiltonian graphs

	5. Trees, spanning trees 6. Shortest paths
Examination forms	Class discussion; quizzes: Mid-term and Final exam: Written exam (closed book).
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Final score is greater or equal to 5.0/10.0
Reading list	***Main book*** **1.** Douglas Brent West**, Introduction to Graph Theory,** 2000 ***References:*** 1. Stein, Drysdale and Bogart, **Discrete Mathematics for Computer scientists**, Addison-Wesley, 2010 2. K. H. Rosen, **Discrete Mathematics and Its Applications**, 8th ed., McGraw Hill, 2019.

14. Computer Algebra - MTH10503

Module designation	**Computer Algebra**
Semester(s) in which the module is taught	6th semester, 8th semester
Person responsible for the module	Dr. Le Van Luyen
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	150 Hours Contact hours: Lectures: 60 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Abstract algebra, Modern algebra
Module objectives/intended learning outcomes	- General objectives: Explore the connection between algebra and computers. Use algebra software to create programs, and check problems related to algebra. - Specific objectives/course learning outcomes: • Knowledge: Arithmetic, polynomial theory, Gröbner basis, cryptography. • Skills: Programming through exercises to install algorithms; using computer algebra systems. • Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics: 1. Number Theory 2. Geometry, Algebra, and Algorithms

	3. Gröbner Bases 4. Multivariate cryptography
Examination forms	Class discussion; quizzes: Mid-term and Final exam: Written exam (closed book).
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Final score is greater or equal to 5.0/10.0
Reading list	***Main book*** 1. Ideals, Varieties, and Algorithms: **An Introduction to Compuational Algebraic Geometry and Commutative Algebra,** Cox, David; Little, John ; O'Shea, Donal ***References:*** 1. **Multivariable Public key cryptosystems**, Jintai Ding, Jason E. Gower, Dieter S. Schmidt. 2. **Computer Algebra, Grobner Bases**, Le Tuan Hoa

15. Algebraic Graph Theory - MTH10504

Module designation	**Algebraic Graph Theory**
Semester(s) in which the module is taught	6th semester, 8th semester
Person responsible for the module	Dr. Nguyen Phuc Son
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	150 Hours Contact hours: Lectures: 60 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	Linear Algebra
Module objectives/intended learning outcomes	- General objectives: The course aims to provide students with basic knowledge of algebraic methods in graphs, especially the theory of universal graphs. - Specific objectives/course learning outcomes: • Knowledge: circular matrix, Laplace matrix, the spectrum of the graph. • Skills: using verification methods and combination methods. • Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics: 1. Preliminaries 2. Spectrum of a graph, 3. Some applications of the spectrum of a graph

Examination forms	Class discussion; quizzes: Mid-term and Final exam: Written exam (closed-book).
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Final score is greater or equal to 5.0/10.0
Reading list	***Main book*** 1. R. B. Bapat, *Graphs and Matrices,* Hindustan Book Agency, 2010 ***References:*** 1. Fan R. K. Chung, *Spectral Graph Theory*, CBMS, AMS, 1997. 2. Dragos Cvetkovix et. al., *An introduction to the theory of graph spectra,* Cambridge University Press, 2010

16. Graded Algebra - MTH10505

Module designation	Graded Algebra
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Dr. TRINH Thanh Deo
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hours (in class) Private study: 120 hours (self-study)
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Abstract algebra, Modern algebra
Module objectives/intended learning outcomes	- General objectives: Equip students with basic knowledge of graded rings and graded modules. - Specific objectives/course learning outcomes: • Knowledge: Equipped with concepts and properties of graded rings, graded modules; primary decompositions of graded submodules; Noetherian and Artinian properties of graded modules; height and dimension in graded rings; Hilbert function and applications. • Skills: Understand the properties of graded algebra to investigate the properties of rings and algebra. • Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics: 1. Concepts and properties of graded rings 2. Concepts and properties of graded modules 3. Primary decompositions of graded submodules

	4. Noetherian and Artinian properties of graded modules 5. Height and dimension in graded rings 6. Hilbert function and applications
Examination forms	Class discussion; quizzes: Mid-term and Final exam: Written exam (closed - book).
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Final score is greater or equal to 5.0/10.0
Reading list	***Main book*** 1. Theoretical basis of module, Duong Quoc Viet, 2010 ***References:*** 1. Steps in communicative algebra, Sharp R.Y., 1990 2. Graded rings and Modules, Tom Marley

17. Graph Algebra - MTH10506

Module designation	Graph Algebra
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Dr. TRINH Thanh Deo
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hours (in class) Private study: 120 hours (self-study)
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Abstract algebra, Modern algebra
Module objectives/intended learning outcomes	- General objectives: Equip students with basic knowledge of Leavitt path algebras. - Specific objectives/course learning outcomes: • Knowledge: Equipped with concepts and properties of Leavitt path algebra, Cohn path algebra, structure of ideals in Leavitt path algebra, simplicity, and structure of idempotents in Leavitt path algebra. • Skills: Understand the properties of Leavitt path algebra through graphs, use graphs to investigate the properties of rings and algebra. • Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics: 1. Overview of rings and modules 2. Graph theory 3. Leavitt path algebra

	4. Basic examples of Leavitt Path Algebra 5. Theorem of Reduction and Uniqueness 6. Structure of ideals in Leavitt path algebra 7. Simplicity of the Leavitt path algebra.
Examination forms	Class discussion; quizzes: Mid-term and Final exam: Written exam (closed - book).
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Final score is greater or equal to 5.0/10.0
Reading list	***Main book*** 1. Leavitt path algebras-A primer and handbook, Gene Abrams, Pere Ara, Mercedes Siles Molina, 2017 ***References:*** 1. Leavitt Path Algebras, Iain Dangerfield, 2011 2. Graph Algebras, Iain Raeburn, 2005 3. A course on Leavitt path algebras, M.S. Molin, 2009

18. An Introduction to combinatorics - MTH10507

Module designation	An Introduction to Combinatorics
Semester(s) in which the module is taught	6th,8th semester
Person responsible for the module	Dr. NGUYEN Anh Thi
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	150 Hours Contact hours: Lectures: 60 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- General objectives: To be familiar with advanced mathematics. - Specific objectives/course learning outcomes: • Knowledge: Mastering the knowledge of advanced counting techniques and applying them to solving counting problems and related contents. • Skills: Applying combinatorics formulas flexibly and correctly. Using generating functions, Sieve formulas, rook polynomials…to solve counting problems. Applying properties of partially order sets and Mobius functions to prove related issuses. Understanding documents related to enumerative combinatorics.

	• Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics: 5. Counting principles 6. Elementary counting problems 7. The binomial theorem and the multinomial theorem 8. Partitions (Set partition and integer partition) 9. Stirling numbers (1st and 2nd kind) + Bell numbers + Catalan numbers 10. The Sieve formula and rook polynomials 11. Generating functions 12. Partially order sets 13. Lattice 14. Mobius functions 15. Hyperplane arrangements
Examination forms	Class discussion; quizzes: Mid-term and Final exam: Written exam (opened - book).
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Final score is greater or equal to 5.0/10.0
Reading list	- Main book 1. **Enumerative Combinatorics,** Nguyễn Anh Thi, VNU-HCM Press, 2022. - References: 1. **Enumerative Combinatorics, vol 1**, Richard. P. Stanley, Cambridge University Press, 1997. 2. **Applied Combinatorics**, Alan Tucker, John Wiley and Sons, Inc., 2002

19. A Brief History of Numbers and Algebra - MTH10601

Module designation	A Brief History of Numbers and Algebra
Semester(s) in which the module is taught	5th and 7th semesters
Person responsible for the module	Assoc. Prof. Mai Hoàng Bien
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures, group work, small group for project.
Workload (incl. contact hours, self-study hours)	Total: 90 Hours Contact hours: Lectures 45 hours (in class) Private study: 45hours (self-study)
Credit points	3 Credits/ 5 ETCS
Required and recommended prerequisites for joining the module	None

Module objectives/intended learning outcomes	General objective: Provide students with an overall perspective on the history of numbers and algebra. Specific objectives/course outcomes: *) Knowledge: Students will grasp the broad process of historical development in both numbers and algebra. They will acquire basic knowledge of contemporary software that facilitates research and teaching in mathematics, offering valuable information for future work or further studies after graduation. *) Skills: Throughout this course, students will develop two key skills. First, a deep understanding of the historical progression of numbers and algebra, enabling them to make informed predictions about future developments. Second, the application of specific mathematical software to a particular task. *) Attitude, Attendance: Foster an objective view of the evolution of numbers and algebra, laying the foundation for a positive attitude throughout the learning process.
	The course "a brief history of numbers and algebra" is an elective within the program algebra and number theory. However, it is open to students of all backgrounds who have an interest in the historical aspects of mathematics, particularly in the history of number theory and algebra. It provides students with a comprehensive overview of the historical development of numbers, enriching their understanding as they study other related courses. Furthermore, the course introduces some general databases relevant to mathematics.
Content	Chapter 1: History of Ancient Mathematics 1.1. Language and Objectives 1.2. Some Ancient Civilizations 1.3. Influential Ancient Mathematicians Chapter 2: History of Numbers 2.1. Purpose of Numbers 2.2. Historical Development of Number Systems 2.3. Number Systems, Measurement, and Counting in History 2.4. Legends about Numbers 2.5. The Infinite Odyssey of Humanity. Chapter 3: History of Algebra 3.1. History of Classical Algebra 3.2. Logic, Computers, and the Limits of Thought 3.3. History of Abstract Algebra 3.4. From Algebra to Geometry, Mechanics, Analysis

	3.5. From Algebra to Other Branches. Chapter 4: Mathematical Databases 4.1. Mathscinet, zbmath, Referativny Zhurnal 4.2. Mathematical Journals 4.3. Some Mathematical Societies 4.4. Universities and Research Institutes in Vietnam 4.5. Some Annual Mathematical Conferences in Vietnam 4.6. Highlights of the History of Mathematics in Vietnam Through Statistical Figures. Chapter 5: Overview of Some Mathematical Software 5.1. LaTeX 5.2. MAPLE, MATLAB 5.3. GAP 5.4. Some Other Software. Chapter 6: Conclusion Review, Practice Chapter 5, and Conclusion.
Examination forms	Class discussion; quizzes: Mid-term and Final exam: Written exam and homework.
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Mid-term and Final score are 5.0/10.0
Reading list	[1] Israel Kleiner, A history of abstract algebra, Springer, 2007 [2] John Tabak, Numbers: computers, philosophers, and the search for meaning, Facts on file, 2004 [3] L. Heaton, A brief history of mathematical thought, Oxford Uni. Press, 2017. [4] Nguyễn Cang, Lịch Sử Toán Học (Vietnamese), NXB Trẻ, 1999

20. An Introduction to Division Rings - MTH10602

Module designation	An Introduction to Division Rings
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Dr. Nguyen Van Thin (A)
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lectures, small group solving exercises
Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hours (in class) Private study: 120 hours (self-study)
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Modern Algebra
Module objectives/intended learning outcomes	- General objectives: To be familiar with Division Rings. - Specific objectives/course learning outcomes: • Knowledge: Understand the concepts and basic properties of Division Rings, structure of some Division Rings, properties of Polynomial Rings on Division Rings. • Skills: Solving basic problems on Division Rings. Solving exercises on polynomial rings on Division Rings. • Attitude: Attend all classroom sessions and discussions outside of class time.
Content	This module includes the following topics: 1. Basic properties on Division Rings. 2. Some structures about Division Rings. 3. Polynomial on Division Rings.
Examination forms	Class discussion; quizzes: Mid-term and Final exam: Written exam (closed - book).
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Final score is greater or equal to 5.0/10.0
Reading list	- Main book 1. T.Y. Lam, **A first course in noncommutative Rings**, 1991. - References: 1. P.K. Draxl , **Skew Fields**, 1982. 2. W. R. Scott, **Group Theory**, 1987.

21. An Introduction to Group Algebras - MTH10603

Module designation	An Introduction to Group Algebras
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Assoc. Prof. Mai Hoàng Bien
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures, group work, small group for project.
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: Lectures: 45 hours + 30 exercises hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	General Objective: The course equips learners with a highly important topic in the field of algebra and establishes connections with various related themes and directions. Specific Objectives/Course Outcomes: *) Knowledge: Acquire an understanding of the concepts and definitions of group algebra and apply them to solve relevant exercises. *) Skills: Solve exercises and establish connections with other research directions, such as group representation theory. *) Attitude, Attendance: Demonstrate diligence and completeness in solving exercises
Content	Chapter 1: Review of Fundamental Concepts Chapter 2: Group Algebra 2.1. Basic Concepts of Group Algebra 2.2. Some Special Group Algebras Chapter 3: Ideals in Group Algebra 3.1. Linear Ideals in Group Algebra 3.2. Prime and Semiprime Ideals in Group Algebra 3.3. Semiprime Ideals in Group Algebra Chapter 4: Elements in Group Algebra 4.1. Algebraic Elements in Group Algebra 4.2. Linear Elements in Group Algebra 4.3. Invertible Elements in Group Algebra 4.4. Group Multiplication of Invertible Elements in Group Algebra Chapter 5: Some Open Problems 5.1. Problems Related to Isomorphism 5.2. Problems Related to Group Multiplication 5.3. Some Other Problems

	Review
Examination forms	Class discussion; quizzes: Mid-term and Final exam: Written exam and homework.
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Mid-term and Final score are 5.0/10.0
Reading list	[1] Polcino Milies, César; Sehgal, Sudarshan K., An introduction to group rings, Algebras and Applications. 1. Dordrecht: Kluwer Academic Publishers. xi, 371(2002) [2] Sehgal, Sudarshan K., Topics in group rings, Monographs and Textbooks in Pure and Applied Mathematics 50. New York - Basel: Marcel Dekker, Inc. (1978)

2.2.3. Specialization in Analysis

1. Real Analysis - MTH10436

Module designation	Real Analysis
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Assoc. Prof. Ly Kim Ha
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	Total: 150 hours Contact hours: lectures 60 hours *(in-class)*. Private study: 90 hours *(self-study)*.
Credit points	4 credits / 6.0 ECTS
Required and recommended prerequisites for joining the module	Prerequisites: Analysis 1A, 2A, Functional Analysis
Module objectives/intended learning outcomes	The course aim to develop a rigorous understanding of the foundations of real numbers and mathematical analysis and introduce students to the concept of convergence, continuity, differentiability, and integrability of real functions.. This course also provide students with the tools and techniques necessary for analyzing and proving properties of real-valued functions. Finally, it is designed to cultivate logical reasoning and mathematical maturity in approaching problems related to calculus and real analysis.
Content	Chapter 1: Foundations of Real Numbers Chapter 2: Sequences and Series Chapter 3: Limits and Continuity Chapter 4: Differentiation Chapter 5: Integration Chapter 6: Sequences and Series of Functions Chapter 7: Metric Spaces
Examination forms	Midterm and final exam: written exams.

Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Principles of Mathematical Analysis. Walter Rudin, McGraw-Hill, 1976. 2. Introduction to Real Analysis. Robert G. Bartle and Donald R. Sherbert, Wiley, 2011.

2. Numerical Analysis 1 - MTH10410

Module designation	Numerical Analysis 1
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	Dr. Ông Thanh Hải, Department of Analysis
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	Total: 165 hours Contact hours: Lectures 45 hours + 30 practice hours in laboratory *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	General Objective: To introduce the basic concepts and approximation methods of numerical analysis, and to provide students with the tools to find approximate solutions to problems involving equations and systems of equations. By finding algorithms to solve the problems posed, this module aims to equip students with knowledge to solve real problems based on theoretical math knowledge and the means of computations. The course helps students to understand the following knowledge: understand the concept of approximation and types of errors. Understand the most basic

	approximation methods and their applications. Application of computational software in numerical calculations.
Content	The content of the course includes in the approximate theories and their application to find the approximate solutions of the single variable equations and th system of linear equations, and the approximate derivative, integral... These methods which are applied into the physical problems, are used by the Matlab program to simulate.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Numerical Analysis. Ninth Edition. Brooks, Burden and Faires, 2010 2. Numerical Analysis. Pearson, Sauer, 2006 3. Numerical Analysis. Brooks/Cole Publishing Company, Kincaid, W. Cheney, 1991 4. Numerical methods using Matlab. Third Edition. Prentice Hall, J. H. Mathews, K. D. Frink, 1999

3. Qualitative Theory of Differential Equations - MTH10411

Module designation	Qualitative Theory of Differential Equations
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Dr. Le Duc Hung
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	Total: 150 hours Contact hours: lectures 60 hours *(in-class)*. Private study: 90 hours *(self-study)*.
Credit points	4 credits / 6.0 ECTS
Required and recommended prerequisites for joining the module	Prerequisites: Analysis 1A, 2A, 3A, 4A, Linear Algebra
Module objectives/intended learning outcomes	This course delves into advanced topics in ordinary differential equations (ODEs) and dynamical systems, equipping students with a deep understanding of the mathematical structures governing dynamic phenomena. The curriculum covers fundamental theorems such as the

	Gronwall-Bellman lemma, existence, and uniqueness theorems, exploring their applications in diverse contexts.
Content	Basic theorems (Gronwall-Bellman lemma, existence, uniqueness, theorems on existence interval and dependence on initial conditions). System of differential equations (forms of the system and methods of integration, methods of solving ODEs). Other types of ODEs (slow differential equations, random equations, complex ODEs, functional ODEs, ODEs in Banach space, ODEs on manifolds, differential envelopes). Experimental properties (dynamics, stability, branching, topological equivalence)
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Phương trình Vi phân, Nguyễn Đình Phư, NXB ĐHQG TP HCM, 2002 2. Những chương bổ sung phương trình vi phân, Arnold V, NXB Nauka, 1978 3. Ordinary Differential Equations, Hartman Ph., John Wiley and Sons, New York, 1964 4. Phương trình vi phân, Hoàng Hữu Đường, Võ Đức Tôn, Nguyễn Thế Hoàn, NXB Đại học và Trung học chuyên nghiệp Hà Nội 1970.

4. Complex Variable Functions - MTH10412

(see description of this module in Specialization in Mechanics)

5. Equations of Mathematical Physics - MTH10413

(see description of this modul in Specialization in Mechanics)

6. Partial Differential Equations - MTH10414

Module designation	Partial Differential Equations
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Prof. Đặng Đức Trọng
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	Total: 150 hours Contact hours: Lectures 60 hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS

Required and recommended prerequisites for joining the module	Prerequisites: Real Analysis, Functional Analysis
Module objectives/intended learning outcomes	General objective: To equip students with some knowledge of qualitative theory of partial differential equations for further study in the field of research on partial differential equations or in applied mathematics.
Content	Study the existence of solutions of Elliptic, Hyperbolic, Parabolic equations on Sobolev spaces.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Functional Analysis, Sobolev spaces and partial differential equations, Heim Brezis, 2011 2. Applied partial differential equations, Paul Duchateau, David Zachman, 1989 3. An introduction to semilinear evolution equations, Thierry Cazenave, Alain Haraux, 1998 4. Partial differential equations, Lawrence C. Evans, 2010 5. Partial differential equations, Mikhailov, 1977

7. Finite Element Analysis - MTH10415

Module designation	Finite Element Analysis
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Dr. Ông Thanh Hải - Department of Analysis
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures, labwork
Workload (incl. contact hours, self-study hours)	Total: 165 hours Contact hours: lectures 45 hours + 30 practical lessons in laboratory. Private study: 90 hours *(self-study).*
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Functional analysis, Introduction to numerical analysis.

Module objectives/intended learning outcomes	General objectives: Introduces the basic concepts and approximation methods of numerical analysis and provides students with the tools to find approximate solutions to problems involving partial differential equations using finite element analysis. The course helps students to acquire the following knowledge: understand the concept of the best approximation with different spatial standards and how to find these best approximations. Understand the concept of weak and classical solutions to elliptic problems with boundary conditions. Understand the concept of a two-dimensional partial polynomial approximation and obtain an analytic error assessment of this approximation. There is an evaluation of simulation computational problems for the diffusion problem.
Content	The course includes approximation theories and applications to find numerical solutions to linear elliptic partial differential problems using the finite element method. This method has been used to solve real problems corresponding to physical phenomena, such as diffusion, convection, elasticity... Besides, we emphasize the accuracy evaluation, stability of approximate solutions using a priori, stable, and posterior evaluation techniques. Finally, we use the Matlab programming language to simulate the finite element method in the diffusion and elasticity problem.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Numerical Approximation of Partial Differential Equations, Alfio Quarteroni, 1996. 2. The Finite Element Method, C. Zienkiewicz, and R. L. Taylor, 2000. 3. The Finite Element Method, Philippe G. Ciarlet, 1978. 3. Functional Analysis, Approximation Theory and Numerical Analysis, John M. Rassias, 1994. 4. The Finite Element Method using Matlab, Young W. Kwon and Hyochoong Bang, 1997.

8. Topology - MTH10417

Module designation	Topology
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Dr. Huỳnh Quang Vũ, Department of Analysis

Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	Total: 150 hours Contact hours: lectures 60 hours *(in-class)*. Private study: 90 hours *(self-study)*.
Credit points	4 credits / 6.0 ECTS
Required and recommended prerequisites for joining the module	Required: Functional Analysis
Module objectives/intended learning outcomes	General Objective: The course aims to provide students with basic concepts, languages, methods, and results of Topology, which are commonly used in mathematics. The subject is first and foremost useful for students of theoretical mathematics, especially Analysis, in addition to Algebra and Optimization. On the other hand, recently some contents of Topology have been applied to computation, so students of computer science can also learn useful things. In addition to knowledge, this subject is a very suitable place to practice thinking at a high level of abstraction, generality and precision. Specific objectives/course learning outcomes: Knowledge: understand and apply basic concepts and results of general topology. Do some topological reasoning. For good students lay the foundation and impetus for further research on topology. Skills: achieve the ability to absorb and implement some reasoning at a high level of generalization and abstraction. Attitude, diligence: Seeing the need to develop generalization and abstraction, thereby helping to investigate new problems, under a new perspective, from which to have a serious, proactive and self-disciplined learning attitude.
Content	The content of this course includes general topology, also known as point set topology including: topological space, continuous mapping, homeomorphisms, connectedness, separation, convergence, compactness, Tikhonov's theorem, Alexandroff's compactification, Urysohn's theorem, space of continuous functions, quotient topology, ...
Examination forms	Written, may include a project

Study and examination requirements	Assignments: 50%, Final Exam: 50% + Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Lecture notes on Topology, Huỳnh Quang Vũ, available freely online. 2. Topology: A first course, James R. Munkres, 2000. 3. Introduction to Topology: Pure and Applied, Colin Adams, Robert Fransoza, 2009.

9. Nonlinear Analysis - MTH10409

Module designation	Nonlinear Analysis
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Dr. BUI Le Trong Thanh
Language	Vietnamese
Relation to curriculum	Optional
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	Total: 180 Hours Contact hours: Lectures: 60 hours (in class) Private study: 120 hours (self-study)
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Analysis 1A, 2A, 3A, Measure Theory, Real Analysis, Linear PDEs
Module objectives/intended learning outcomes	- General objectives: To be familiar with advanced mathematics. - Specific objectives/course learning outcomes: • Knowledge: Mastering the knowledge of the various types of the fixed point theorems such as Banach, Schauder, Schaefer, Lerray-Schauder and applying them to solving Ordinary Differential Equations (ODEs), Partial Differential Equations (PDEs) and their systems. • Skills: Proving the various types of the fixed point theorems; solving the (systems of) ODEs or PDEs. • Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics: 1. The fixed point Theorems 2. Solving the ODEs 3. Solving the nonlinear PDEs 4. Solving the systems of ODEs/PDEs
Examination forms	Class discussion; quizzes: Mid-term and Final exam: Written exam (closed - book).

Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Final score is greater or equal to 5.0/10.0
Reading list	- Main book 1. **Nonlinear Functional Analysis and its Applications I: Fixed-Point Theorems,** E. Zeidler (Springer 1986). - References: 1. **Functional Analysis, Sobolev spaces and Partial Differential Equations**, H. Brezis (Springer 2010).

10. Analysis Seminar - MTH10451

Module designation	Analysis Seminar
Semester(s) in which the module is taught	6th, 7th, 8th semester
Person responsible for the module	Assoc. Prof. LY Kim Ha, Dr. HUYNH Quang Vu, Dr. ONG Thanh Hai, Dr. NGUYEN Thanh Long
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	150 Hours Contact hours: Lectures: 60 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Functional Analysis, Partial Differential Equations, Numerical Analysis 1
Module objectives/intended learning outcomes	Learn more deeply about students's major with greater self-study under the guidance of a lecturer, and prepare to write student's undergraduation thesis
Content	This module includes the following topics: 1. Issues that have not been mentioned in the subjects of the major. 2. Problems that arise in subjects within the major but have not been resolved. 3. The necessary knowledge is not included in the program to prepare for the expected graduation thesis topic.
Examination forms	Depends on the instructors
Study and examination requirements	Final score is greater or equal to 5.0/10.0
Reading list	Depends on the instructors

11. Ill-posed problems - MTH10461

Module designation	Ill-posed problems
Semester(s) in which the module is taught	8th semester
Person responsible for the module	Prof. DANG Duc Trong, Dr. TRAN Thi Khieu
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	150 Hours Contact hours: Lectures: 60 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Functional Analysis, Real Analysis
Module objectives/intended learning outcomes	This course introduces the students to the area of ill-posed problems. The study of Ill-posed problems is of vital interest to many areas of science and technology such as geophysical exploration, system identification, nondestructive testing and ultrasonic tomography.
Content	This module includes the following topics: 1. Introduction and Basic Concepts 2. Regularization Theory for Equations of the First Kind 3. Regularization by Discretization 4. Inverse Eigenvalue Problems
Examination forms	Final exam: Written exam (opened - book).
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Final score is greater or equal to 5.0/10.0
Reading list	- Main book: [1] *Andreas Kirsch, An Introduction to the Mathematical Theory of Inverse Problems, Springer, 2011* - References: [2] A. Bakushinsky, A. Goncharsky, Ill-Posed Problems: Theory and Applications, Springer, 1994

12. Measure Theory and Integration - MTH10462

Module designation	Measure Theory and Integration
Semester(s) in which the module is taught	4th -5th semester
Person responsible for the module	Dr. BUI Le Trong Thanh
Language	Vietnamese
Relation to curriculum	Optional
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hours (in class) Private study: 120 hours (self-study)
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Analysis 1A, 2A
Module objectives/intended learning outcomes	- General objectives: To be familiar with advanced mathematics. - Specific objectives/course learning outcomes: • Knowledge: Mastering the knowledge of the measure, measure space, Lebesgue measure, Lebesgue integral, the convergence Theorems, product measure, Radon-Nikodym and applying them to solving the fundamental and advanced exercises. • Skills: Proving the convergence Theorems such as monotone Convergence, Dominated Convergence, Vitali Convergence, Fubini-Tonelli Theorems; solving the basis and advanced exercises. • Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics: 1. Sigma algebra, measure and measure space 2. Lebesgue measure 3. Measurable functions 4. Lebesgue integral 5. Monotone Convergence, Fatou Lemma, Dominated Convergence, Vitali Convergence 6. Product measure, Fubini-Tonelli, Radon-Nikodym
Examination forms	Class discussion; quizzes: Mid-term and Final exam: Written exam (closed - book).
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Final score is greater or equal to 5.0/10.0
Reading list	- Main book 1. **Real Analysis: theory of measure and integration,** J. Yeh (2014).

	- References: 2. **Real and complex analysis**, W. Rudin (McGraw-Hill 1987).

13. Stochastic Differential Equations - MTH10473

Module designation	**Stochastic Differential Equations (SDE)**
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Dr. Nguyễn Tiến Đạt
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	175 Hours Contact hours: Lectures: 75 hour *(in class)* Private study: 100 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Recommended prerequisites: Measure Theory and Probability.
Module objectives/intended learning outcomes	This course provides fundamental knowledge on stochastic calculus (Itô integral and Itô formula, etc.), fundamental concepts in theory of SDE as well as introduce some well-known SDEs. In addition, some applications of SDEs in other fields such as financial mathematics, are discussed. - Knowledge: get familiar with basic concepts in theory of stochastic calculus and SDEs. - Skills & competences: cognitive and practical abilities to use these knowledges in conducting stochastic calculus and studying SDEs.
Content	This module includes the following topics: 1. Review on fundamentals in measure theory and probability. 2. Stochastic processes. 3. Stochastic integrations. 4. Stochastic differential equations. 5. Diffusion. 6. Applications of SDEs in other fields.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 80%. + Overall grade: minimum 5.0/10.0.
Reading list	Main course material: 1. Lecture notes, Nguyễn Tiến Đạt, 2023. References: 2. Bernt Øksendal, Stochastics Differential Equations: An introduction with applications (6 ed.), Springer, 2013. 3. Lawrence C. Evans, *Introduction to Stochastic Differential Equations*, AMS, 2013.

	4. Jean-François Le Gall, *Brownian motion, martingales and stochastic calculus*, Springer, 2016.

14. Harmonic Analysis - MTH10476

Module designation	Harmonic Analysis
Semester(s) in which the module is taught	8th semester
Person responsible for the module	Dr. DAO Nguyen Anh
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	150 Hours Contact hours: Lectures: 60 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Functional Analysis, Real Analysis
Module objectives/intended learning outcomes	Basic course on harmonic analysis applicable into geometric problems and partial differential equations.
Content	This module includes the following topics: 1. Poisson integrals 2. Hardy-Littlewood maximal functions 3. Non-tangential convergence of harmonic functions 4. Sub-harmonicity, super-harmonicity 5. Hardy space 6. Riesz's Interpolation Theorem. 7. Littlewood-Paley theory 8. Applications in mechanics and geometry
Examination forms	Final exam: Written exam (opened - book).
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Final score is greater or equal to 5.0/10.0
Reading list	- Main book: [1] *E.M. Stein and G. Weiss, Introduction to Fourier analysis on Euclidean spaces, Princeton, new Jersey, 1971* - References: [2] W. Rudin, Real and complex analysis, . McGraw-Hill, New York 1970

15. Differential topology - MTH10478

Module designation	Differential Topology
Semester(s) in which the module is taught	6th, 8th semester
Person responsible for the module	Dr. Huỳnh Quang Vũ
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 120 hours Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 60 hours Private study including examination preparation, specified in hours: 60 hours
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Analysis 1A, 2A, 3A (required); Topology (recommended)
Module objectives/intended learning outcomes	This course is designed to help students to grasp fundamental notions, methods, and results of beginning differential topology. The course focuses on discussing important and representative examples, the main ideas of notions, arguments and proofs. For some students, certain fundamental but difficult to prove results can be assumed. The main objects are smooth manifolds, generalizations of curves and surfaces. Part of the course is a development of multivariable calculus. The course foremostly benefits students interested in theoretical mathematics, especially in areas related to geometry and physics, and is useful for areas such as differential equations, nonlinear analysis, partial differential equations, mechanics, .. Specific objectives/course learning outcomes: • Knowledge: The students should be able to demonstrate understanding of key concepts and results. • Skills: able to form mathematical arguments. Analyze facts, arguments, and proofs. Study and present small topics not covered in class. • Attitude, diligence: a serious, proactive and self-disciplined learning attitude.
Content	Basic differential topology, mainly topology of smooth manifolds: critical points, regular values, topology of level sets, Morse lemma, orientations, flows, degrees of maps, integration on manifolds, ...
Examination forms	Assignments 60%; Final exam 40% (written, in-class, problem-solving)

Study and examination requirements	Minimum class attendance: 80% Minimum class grade: 50%
Reading list	[1] Huỳnh Quang Vũ, Lecture notes on Topology, https://sites.google.com/view/hqvu/teaching Reference: [1] John Milnor, Topology from the differentiable viewpoint, Princeton landmarks in Mathematics and Physics, Princeton University Press, 1997. [2] Victor Guillemin and Alan Pollack, Differential topology, Prentice-Hall, 1974. [3] Anant R. Sastri, Elements of Differential Topology, CRC Press, 2011. [4] Loring W. Tu, Introduction to manifolds, Springer, 2nd ed., 2013. [5] John M. Lee, Introduction to smooth manifolds, 2nd ed., Springer, 2013.

16. Differential Geometry - MTH10480

Module designation	Differential Geometry
Semester(s) in which the module is taught	6th, 8th semester
Person responsible for the module	Dr. Huỳnh Quang Vũ
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 120 hours Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 60 hours Private study including examination preparation, specified in hours: 60 hours
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Analysis 1A, 2A, 3A (required); Topology (recommended)
Module objectives/intended learning outcomes	This course studies differential geometry of curves and surfaces. Specific objectives/course learning outcomes: • Knowledge: The students should be able to demonstrate understanding of key concepts and results relating to the notions of differential geometry particularly curvatures. • Skills: able to compute in concrete cases and to form mathematical arguments. • Attitude, diligence: a serious, proactive and self-disciplined learning attitude.

Content	Curves (curvature, Serret-Frenet frame); surfaces (2-dimensional manifolds in R^3); The Gauss map and curvatures; principal curvatures; isometries and invariance of Gaussian curvature; geodesics and local equations; The Gauss-Bonnet theorem (not full proof); briefly on higher dimensions and hyperbolic spaces.
Examination forms	Assignments 60%; Final exam 40% (written, in-class, problem-solving)
Study and examination requirements	Minimum class attendance: 80% Minimum class grade: 50%
Reading list	1. A. do Carmo, Differential geometry of curves and surfaces, 2nd edition, 2016. Giáo trình chính. 2. A. Pressley, Elementary differential geometry, Springer, 2010. 3. Wolfgang Kuhnel, Differential Geometry: Curves, Surfaces, Manifolds, 2nd ed., AMS, 2006. 4. V. Rovenski, Modeling of curves and surfaces with Matlab, Springer, 2010. 5. P. Wilson, Curved Spaces: From Classical Geometries to Elementary Differential Geometry, Cambrige University Press, 2008. 6. Một số tài liệu tiếng Việt nếu tìm được, như giáo trình của Đoàn Quỳnh, của các đại học sư phạm. 7. A. do Carmo, Riemannian geometry, 1992. 8. M. Spivak, A comprehensive introduction to differential geometry, vol. 1, vol. 2, Publish or Perish, 1999.

17. Algebraic Topology - MTH10492

Module designation	Algebraic Topology
Semester(s) in which the module is taught	6th, 8th semester
Person responsible for the module	Dr. Huỳnh Quang Vũ
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 120 hours Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 60 hours Private study including examination preparation, specified in hours: 60 hours
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Analysis 1A, 2A, 3A (required); Topology (recommended)

Module objectives/intended learning outcomes	This course is designed to help students to grasp fundamental notions, methods, and results of beginning combinatorial and algebraic topology. The course focuses on discussing important and representative examples. Certain fundamental but difficult to prove results, such as equivalence among homologies, will be assumed. The course foremostly benefits students interested in theoretical mathematics. Recently certain aspects of algebraic topology have been applied to Computer Science, so students interested in Computer Science might also find this course beneficial. Specific objectives/course learning outcomes: • Knowledge: The students should be able to demonstrate understanding of key concepts and results. • Skills: able to compute in concrete cases and to form mathematical arguments. Analyze facts, arguments, and proofs. Study and present small topics not covered in class. • Attitude, diligence: a serious, proactive and self-disciplined learning attitude.
Content	Basic combinatorial and algebraic topology: simplicial complex, cell complex, homotopy, fundamental group, simplicial homology, cell homology.
Examination forms	Assignments 60%; Final exam 40% (written, in-class, problem-solving)
Study and examination requirements	Minimum class attendance: 80% Minimum class grade: 50%
Reading list	[1] Huỳnh Quang Vũ, Lecture notes on Topology, https://sites.google.com/view/hqvu/teaching Reference: [1] Fred H. Croom, Basic concepts of algebraic topology, Springer-Verlag, 1978. [2] M. A. Amstrong, Basic topology, Springer, 1983. [3] Klaus Jänich, Topology, Undergraduate Texts in Mathematics, Springer-Verlag, 1984. [4] James Munkres, Topology a first course, 2nd ed., Prentice-Hall, 2000. [5] Hatcher, Allen, Algebraic Topology, Cambridge, 2001.

18. Theory of functions of several complex variables - MTH10494

Module designation	Theory of functions of several complex variables
Semester(s) in which the module is taught	8th semester
Person responsible for the module	Assoc. Prof. LY Kim Ha, Assoc. Prof. TRAN Vu Khanh
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	Total: 150 Hours Contact hours: Lectures: 60 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Functional Analysis, Real Analysis, One complex variable function
Module objectives/intended learning outcomes	This course concludes an elementary level with standard local results, followed by a thorough discussion of the various fundamental concepts of "complex convexity" related to the remarkable extension properties of holomorphic functions in more than one variable. It then continues with a comprehensive introduction to integral representations, and concludes with complete proofs of substantial global results on domains of holomorphy and on strictly pseudoconvex domains in C"
Content	This module includes the following topics: 1. Elementary Local Properties of Holomorphic Functions 2. Domains of Holomorphy and Pseudoconvexity 3. Differential Forms and Hermitian Geometry 4. Integral Representations in $\mathbb{C}$ n 5. The Levi Problem and the Solution of $\bar{\partial}$ on Strictly Pseudoconvex Domains 6. Function Theory on Domains of Holomorphy in $\mathbb{C}$ n
Examination forms	Final exam: Written exam (opened - book).
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Final score is greater or equal to 5.0/10.0
Reading list	- Main book: [1] *M. Range, Holomorphic functions and Integral representations in Several Complex Variables, Springer, 1986.* - References: [2] S. Krantz, Function Theory of Several Complex Variables, AMS Book, 2001.

2.2.4. Specialization in Numerical Analysis

1. **Numerical Analysis 1 - MTH10410**

(see description of this module in Specialization in Analysis)

2. **Partial Differential Equations - MTH10414**

(see description of this module in Specialization in Analysis)

3. **Finite Element Analysis - MTH10415**

(see description of this module in Specialization in Analysis)

4. **Real Analysis - MTH10436**

(see description of this module in Specialization in Analysis)

5. **Numerical methods in linear algebra - MTH10439**

Module designation	Numerical Methods in Linear Algebra
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Dr. Nguyen Thi Hoai Thuong
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	lectures, exercises, practice sessions
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 practical lessons in laboratory. Private study: 90 hours *(self-study)*.
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Calculus 1A, 2A, Linear Algebra
Module objectives/intended learning outcomes	General objectives: This course provides basic concepts and algorithms related to linear algebraic computations on computers. This is an important foundation for computational science and engineering problems such as image and signal processing, computational finance, mechanics, ... Intended learning outcomes: Knowledge: Basic concepts in applied linear algebra such as calculating matrices, solving systems of equations, matrix analysis method (Singular Value decomposition, Eigenvalue decomposition, LU decomposition, QR decomposition),.. QR decomposition method. Least Squares Problem. How to solve a system of linear equations on a computer. Evaluate the

	accuracy and stability of the algorithm. Analytical method of matrix eigenvalues.
Content	Linear algebra problems appear from many practical applications in physics, biology, mathematics, and computer science. The course includes theory and methods to solve these problems on computers. In addition to related concepts, the course introduces basic algorithms to solve calculations on matrices. The course also emphasizes the evaluation of the complexity and stability of algorithms. Finally, students use Matlab language to install on computers.
Examination forms	Writing (Midterm: 30%, Final exam: 70%)
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Numerical Linear Algebra, Lloyd N. Trefethen, David Bau, 1997. 2. Matrix Computation, Gene H. Golub and Charles F. Van Loan, 1996.

6. Hyperbolic Systems of Conservation Laws - MTH10444

Module designation	Hyperbolic Systems of Conservation Laws
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Dr. Nguyễn Thị Hoài Thương, Department of Analysis
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 practical lessons in laboratory. Private study: 90 hours *(self-study)*.
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Linear Algebra, Introduce to finite volume methods and their applications Subject requirements: basic programming skills.

Module objectives/intended learning outcomes	General objectives: The hyperbolic Systems of Conservation laws describe a large number of physics problems in fields as diverse as: fluid dynamics, solid mechanics, astrophysics,... The introductory concept of hyperbolic Systems of Conservation laws, is also a continuation of the course "Introduction to finite volume methods and applications". Thereby, students gain an initial background of several research directions in academia as well as industry. Intended learning outcomes: ● Knowledge: Hyperbolic Systems of Conservation laws simulate real problems. Mathematical basis of forming a conserved hyperbolic system. Linear and nonlinear hyperbolic partial differential equations. Initial value problem. Riemann problem and how to find exact solutions in some specific problems. Linear advection equations, linear aerodynamics, Burgers equations,... Apply the finite volume method to find the numerical solution of the hyperbolic partial differential equation.
Content	The theory of hyperbolic partial differential equations have a large role in numerical analysis and its applications cover almost all fields such as: fluid dynamics, aerodynamics, elastic theory, optics. The course provides students with the necessary knowledge about the theory of linear and nonlinear hyperbolic partial differential equations as well as numerical methods to find exact solutions (in some problems) and approximations of these equations. The actual computation on the machine is done in one of the following programming languages: Scilab / Matlab / C++ (recommended) / Fortran.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Finite Volume Methods, R. Eymard, T. Gallouet and R. Herbin, 2000. 2. Explicit staggered schemes for compressible flows, Nguyễn Tấn Trung, 2013. 3. Hyperbolic Systems of Conservation Laws, E. Godlewski and P.-A. Raviart, 1991.

7. Introduction to finite volume methods and its applications - MTH10445

Module designation	Introduction To Finite Volume Methods and Its Applications
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Dr. Lê Ánh Hạ, Department of Analysis
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture and Lab work
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 practical lessons in laboratory. Private study: 90 hours *(self-study)*.
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Subject requirements: computational softwares laboratory.
Module objectives/intended learning outcomes	General objectives: In industrial problems in the form of partial differential equations, it is common to find problem solving tools based on finite volume and/or finite element methods. Thereby, these problems, for the most part, are either solved directly, or are reduced to algebraic equations for processing by the built-in tools of computational linear algebra. This course is considered as one of the prerequisites for students to study number theory or work in an industrial environment. Intended learning outcomes: ● Knowledge: The partial differential equations simulate real problems. How to create a grid for discretization by spatial variables. Compare the finite difference and finite volume methods. The implicit and explicit schemes. Solve and simulate on Matlab/Scilab the elliptic, parabolic and hyperbolic partial differential equations. The classical finite volume method and its variations. Analyze the convergence and estimate the error of the methods.
Content	The finite volume method is widely used in numerical simulation of real problems in the form of partial differential equations such

	as nuclear safety, oil and gas exploitation, astronomy, geology, etc.. The course provides students with the necessary knowledge in discretizating the partial differential equations (elliptic, parabolic and hyperbolic) using the finite volume method. The focus of the course is equally divided into both theoretical and practical parts of one of the following programming languages: Scilab/ Matlab/ C++/ Fortran.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. R. Eymard, T. Gallouet and R. Herbin, Finite Volume Methods (2000). 2. Nguyễn Tấn Trung, Explicit staggered schemes for compressible flows (2013). 3. Dương Minh Đức, Giải Tích Hàm, NXB Đại học Quốc gia TP. Hồ Chí Minh (2005).

8. Finite differential Analysis - MTH10610

Module designation	Finite Difference Analysis
Semester(s) in which the module is taught	5th and 7th semester
Person responsible for the module	Dr. Ong Thanh Hai, Department of Analysis
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 practical lessons in laboratory. Private study: 90 hours *(self-study).*
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	MATLAB, Functional analysis, Linear Algebra.

Module objectives/intended learning outcomes	General objectives: The module provides students with an overview of numerical analysis applied in industrial problems. This subject can be considered as a premise for students to get acquainted with mathematical models, numerical analysis and computational science. Moreover, the course is considered as a complement to two important subjects of the major of numerical analysis: finite volume methods and finite element method. Intended learning outcomes: ● Knowledge: The partial differential equations simulate real problems. Classical mathematical models for industrial problems. Finite difference method. Solve and simulate solutions of heat equations and convective equations on a computer. Evaluation of experimental results obtained through numerical methods.
Content	Partial differential equations are a main part of industrial problems. However it is not easy to solve these problems. So this course introduces to students basic steps of numerical schemes to solve industrial problems from discretizing the simple partial differential equations such as: heat equation or diffusion equation. The key of the course includes two parts: theory and practice.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Finite Difference Schemes and Partial Differential Equations, J. C. Strikwerda, 1989. 2.Finite Difference Methods for Ordinary and Partial Differential Equations, R. J. LeVeque, 2007. 3. Numerical Solution of Partial Differential Equations, K. W. Morton and D. F. Mayers, 1995. 4. MATLAB, 2011.

9. Numerical Optimization - MTH10604

Module designation	Numerical Optimization
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Dr. Nguyễn Đăng Khoa, Department of Analysis

Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	lectures and lab works
Workload (incl. contact hours, self-study hours)	Total workload: 187.5 hours Contact hours: Lectures: 75 hours (in class) Private hours: 112.5 hours (self-study)
Credit points	4 Credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	Analysis 1A, Analysis 2A, Analysis 3A; Subject requirements: basic programming skills.
Module objectives/intended learning outcomes	- Knowledge: The course is designed for students majoring in Analysis. We will equip students with the basics of convex analysis, linear programming, and nonlinear programming. Some typical optimization methods, easy to understand and implement, will be selected to introduce to students. After completing this course, students are expected to have mastered the basics of convex analysis, optimal conditions for unconstrained and constrained convex optimization problems, mathematical foundations and fundamental algorithms for solving linear and nonlinear programming. - Skills: Basic equipment for students about matlab programming.
Content	Optimization is an important area of study in applied mathematics. We can understand the optimization problem to determine the best value of the objective function over a given domain. In this course, we will introduce students to some typical numerical methods for solving linear programming, unconstrained and constrained optimization problems. At the same time, students can practice using MATLAB to illustrate some academic examples.
Examination forms	Midterm and final exam: written exams
Study and examination requirements	Check – evaluate the process: weighted 50% Final exam score: weighted 50%
Reading list	1. Hiriart-Urruty, J.B. and Lemaréchal, C., Convex Analysis and Minimization Algorithms, Volumes I and II, Springer, Berlin (1993)

	2. Phan Quốc Khánh và Trần Huệ Nương, Giáo trình Quy hoạch tuyến tính, NXB Giáo dục (2000) 3. Nguyễn Thị Bạch Kim, Giáo trình Các phương pháp Tối ưu – Lý thuyết và Thuật toán, NXB Bách Khoa –Hà nội (2008) 4. Rockafellar R. Tyrrell, Convex Analysis, Princeton University Press (1970) 5. Schnabel Robert B. and Dennis J. E., Numerical methods for unconstrained optimization and nonlinear equations, SIAM (1996) 6. Tạ Quang Sơn, Giáo trình Giải tích Lồi và Tối ưu, NXB Giáo dục Việt Nam (2017) 7. Strodiot J. J., Numerical Optimization, Lecture notes, (2010) 8. Sundaram Rangarajan K., A first course in optimization theory, Cambridge University Press (1996)

10. Topics in Numerical Analysis - MTH10438

Module designation	Topics in numerical analysis
Semester(s) in which the module is taught	Both 7th and 8th semester
Person responsible for the module	Dr. Ông Thanh Hải, Dr. Lê Ánh Hạ, Dr. Phan Thị Mỹ Duyên, Dr. Nguyễn Thị Hoài Thương, Dr. Nguyễn Đăng Khoa
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	Total workload: 240 hours Contact hours: 120 hours Private study including examination preparation, specified inhours: 120 hours
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Recommended prerequisites: Numerical analysis.
Module objectives/intended learning outcomes	Students study various aspects of modern numerical analysis and interdisciplinary knowledge, including calculus, data science, probability, optimization, etc., which are applied in the field of numerical analysis. Module objectives include: • Understanding and analyzing the foundations of numerical analysis, as well as interdisciplinary knowledge used in the field. • Applying these theoretical foundations to solve specific problems, writing computer programs, and representing the numerical results.
Content	Various topics

Examination forms	Essay, oral presentation
Study and examination requirements	Minimum attendance at weekly meeting is 80%. Final defense is required. Final score is greater or equal to 5.0/10.0
Reading list	Depending on the instructors.

11. Numerical Analysis Seminar - MTH10532

Module designation	Numerical Analysis Seminar
Semester(s) in which the module is taught	7th- 8th semester
Person responsible for the module	Dr. Ông Thanh Hải, Dr. Lê Ánh Hạ, Dr. Phan Thị Mỹ Duyên, Dr. Nguyễn Thị Hoài Thương, Dr. Nguyễn Đăng Khoa
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Project, seminar
Workload (incl. contact hours, self-study hours)	Total workload: 240 hours. Contact hours: 120 hours. Private study including examination preparation, specified inhours: 120 hours.
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Successfully completed 124/134 Credits
Module objectives/intended learning outcomes	After completing the course, students will be able to: - Point out the research problems. - Apply fundamental knowledge and theories to analyse. theresearch problem; develop a research framework (model if applicable); and design a solution for the problem. - Use appropriate techniques for solutions. - Demonstrate the scientific contribution and practicalrelevance of the research carried out. - Provide a consistent, well-structured report- Plan and manage learning process. - Present and defend results of the project at the Students'Seminar.
Content	Various topics.
Examination forms	Essay, oral presentation.
Study and examination requirements	Minimum attendance at weekly meeting is 80%. Final defense is required. Final score is greater or equal to 5.0/10.0.
Reading list	Depending on the research topic and supervisors.

2.2.5. Specialization in Optimization

1. Operations Research - MTH10446

Module designation	Operations Research
Semester(s) in which the module is taught	5th semester
Person responsible for the module	MSc. Nguyen Van Thuy
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, do exercises, group work
Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hours (in class) Private study: 120 hours (self-study)
Credit points	4 credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Recommended prerequisites: Linear Programming
Module objectives/intended learning outcomes	Provide students with knowledge and applications of linear programming problems in the form of graphs, networks, and some practical applications.
Content	- Basic concepts of graphs and trees; - Algorithms of network problems; - Network diagram methods; - Concepts of transport problems and algorithms.
Examination forms	Mid-term and Final exam: Written exam
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Phan Quốc Khánh, *Vận trù học*, NXB Giáo Dục, , 2004. 2. Phan Quốc Khánh, Trần Huệ Nương, *Quy hoạch tuyến tính*, NXB Giáo Dục, 2003.

2. Nonlinear programming - MTH10447

Module designation	Nonlinear Programming
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Assoc. Prof. Nguyen Le Hoang Anh
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, do exercises, group work
Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hours (in class) Private study: 120 hours (self-study)
Credit points	4 credits/ 6 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Provide students with basic knowledge about the nonlinear programming and optimality conditions of this problem.
Content	- Concepts of differentiability in normed spaces. - Important theorems in nonlinear analysis: implicit functions, inverse functions, Hahn-Banach, convex set separation theorem, open mapping theorem. - Minimum existence theorems - Optimality conditions, necessary conditions, sufficient conditions, Lagrange multiplier rules. - Duality theorem, saddle point.
Examination forms	Mid-term and Final exam: Written exam
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. McCormick Garth P., Fiacco Anthony V, *Nonlinear programming : sequential unconstrained minimization techniques*, SIAM, 1990. 2. Patriksson M, *Nonlinear programming and variational inequality problems: a unified approach*, Springer, 2013.

3. Optimization models in Economics - MTH10615

Module designation	Optimization Models in Economics
Semester(s) in which the module is taught	4th semester
Person responsible for the module	MSc. Cao Nghi Thuc
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, do exercises, group work
Workload (incl. contact hours, self-study hours)	150 hours Contact hours: Lectures: 30 lectures hours + 30 exercises hours (in class) Private study: 90 hours (self-study)
Credit points	3 credits/ 5 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Provides students with the basic concepts of mathematical modeling in economics.
Content	- Closed and open Leontief model, direct and indirect costs - Labor theory of value, substitution theorem; - Linear optimal model, producible set, efficient production, production constraints, consumption; - Nonlinear optimization model, modern theory of demand, extended theory of production; - Equilibrium in the market economy, budget constraints, Walras-Wald model, Arrow-Debreu-Mckenzie model.
Examination forms	Mid-term and Final exam: Written exam
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Dowling Edward T, *Introduction to Mathematical Economics*, Schaum's Outline Series, 2012. 2. Hoàng Đình Tuấn, *Lý thuyết mô hình toán kinh tế*, ĐH Kinh tế Quốc dân, 2007.

4. Linear programming - MTH10449

Module designation	Linear Programming
Semester(s) in which the module is taught	4th semester
Person responsible for the module	Assco. Prof. Nguyen Le Hoang Anh, MSc. Nguyen Manh Truong Giang
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, do exercises, group work
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: Lectures: 45 lectures hours + 30 exercises hours (in class) Private study: 90 hours (self-study)
Credit points	4 credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Provide students with the tools to solve the linear programming problem, distinguish the types of problems, the original monomorphic, dual, and synthetic methods. How to build models from real problems.
Content	Objective function, constraint, sign constraint, vocabulary, basis solution, extreme point, primal simplex method, duality.
Examination forms	Mid-term and Final exam: Written exam
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Phan Quốc Khánh, Trần Huệ Nương, *Quy hoạch tuyến tính*, NXB Giáo Dục, 2003. 2. V. Chvatal, *Linear Programming*, NewYork, 1983.

5. Numerical Method in Optimization - MTH10450

Module designation	Numerical Method In Optimization
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Dr. Vo Si Trong Long
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, lab works, group work
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: Lectures: 45 lectures hours + 30 lab works hours (in class) Private study: 90 hours (self-study)
Credit points	4 credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Provide students with knowledge and methods to solve constrained and unconstrained optimization problems.
Content	-Basic properties and concepts of algorithms, Direct/Indirect line search method for unconstrained optimization problem. - Deep reduction method, gradient method and conjugate gradient method. - Newton and quasi-Newton methods. -The least squares problem. Kuhn-Tucker Optimality Conditions.
Examination forms	Mid-term and Final exam: Written exam.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Polak Elijah, , *Optimization: algorithms and consistent approximations*, Springer, 1997. 2. Schnabel Robert B, Numerical methods for unconstrained optimization and nonlinear equations, SIAM, 1996.

6. Introduction to convex analysis and convex programming - MTH10543

Module designation	Introduction To Convex Analysis and Convex Programming
Semester(s) in which the module is taught	4th semester
Person responsible for the module	Dr. Vo Si Trong Long
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, do exercises, group work
Workload (incl. contact hours, self-study hours)	150 Hours Contact hours: Lectures: 60 hours (in class) Private study: 90 hours (self-study)
Credit points	4 credits/ 6 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Provide students with knowledge about convex analysis.
Content	- Convex set, affine set, Caratheodory's Theorem. - Convex function, quasi-convex function, lower and upper semicontinuous, continuous, Lipschitz continuous, Karamardian theorem, local minima. - Hahn-Banach theorem, separation form. - Convex programming. - Optimal conditions. - Duality theorem.
Examination forms	Mid-term and Final exam: Written exam
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. R.T. Rockafellar, *Convex Analysis*, Princeton University Press, Princeton, New Jersey, 1970 2. Boris S. Mordukhovich and Nguyen Mau Nam, *An Easy Path to Convex Analysis and Applications*, Morgan & Claypool Publishers, 2013.

7. Optimization Seminar - MTH10616

Module designation	Optimization Seminar
Semester(s) in which the module is taught	6th and 7th semesters
Person responsible for the module	Assoc. Prof. Nguyen Le Hoang Anh
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	project, seminar, group work
Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hours (in class) Private study: 120 hours (self-study)
Credit points	4 credits/ 6 ETCS
Required and recommended prerequisites for joining the module	This course is only for students who meet the following conditions: • overall grade: at least 6.5/10 at the time of registration. • will graduate with a major in Optimization.
Module objectives/intended learning outcomes	Learn more about the Optimization major and prepare for your graduation thesis.
Content	Students will work directly with instructors on a topic. Topic content can be: • Issues that have not been mentioned in the subjects of the Optimization major; • Problems that arise in Optimization subjects but have not been resolved. • The latest results from around the world and upcoming results from professors, lecturers, and graduate students of the Department of Optimization and Systems.
Examination forms	Mid-term and Final exam: report (or written exam, if necessary)
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Updated from the latest scientific information depending on the discussion content and provided by the instructor.

8. Multi-objective optimization - MTH10553

Module designation	Multiobjective Optimization
Semester(s) in which the module is taught	6th semester
Person responsible for the module	MSc. Nguyen Manh Truong Giang
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Problem lecture with a multimedia presentation
Workload (incl. contact hours, self-study hours)	150 Hours Contact hours: Lectures: 60 hour *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	This course provides fundamental knowledge about multiobjective problems and algorithms related to this class of problems. - Knowledge: get familiar with basic concepts in theory of multiobjective optimization problem model, concept of solution and corresponding algorithm. - Skills & competences: Establish multiobjective optimization models for practical problems. Describe multiobjective optimization solution structures. Appreciate multiobjective optimization methods. Solve bicriteria linear optimization problems. - Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics: Solution concepts and some properties of solutions 2. Duality 3. Multiobjective linear programming 4. Multiobjective programming
Examination forms	Midterm and final exam: written exams
Study and examination requirements	+ Class-attendance: at least 70%. + Final score is greater or equal to 5.0/10.0
Reading list	1. Y. Sawaragi, H. Nakayama, and T. Tanino, *Theory of Multiobjective Optimization*, Elsevier, 1984. 2. D. T. Luc, *Multiobjective Linear Programming*, Springer, 2014. *3.* S. Woifram, *Multicriteria optimization in engineering and in the sciences*, Springer Science & Business Media, 1988

9. Applied Optimization - MTH10538

Module designation	Applied Optimization
Semester(s) in which the module is taught	6th semester
Person responsible for the module	MSc. Nguyen Manh Truong Giang
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hour *(in class)* Private study: 120 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	The subject provides different knowledge orrented to applications of optimization. The field of the subject is quite broad and depends on the documents and recently developed applications, which can be: linear or nonlinear network problems, economic mathematics, equilibrium in competitive markets, Optimal control problem, design problems.
Content	The course provides different knowledge in optimization and recently recently developed applications.
Examination forms	Midterm and final exam: written exams
Study and examination requirements	+ Class-attendance: at least 70%. + Final score is greater or equal to 5.0/10.0
Reading list	1. Bùi Minh Trí, *Tối ưu hoá*, NXB Giáo Dục, 2006. 2. Nguyễn Nhật Lệ, *Tối ưu hoá ứng dụng*, NXB Giáo Dục, 2001. *3.* Nguyễn Quan Đông, Ngô Văn Thứ, Hoàng Đình Tuấn, *Mô hình toán kinh tế*, Trường Đại học Kinh Tế Quốc Dân, 2006.

10. Advanced Linear Programming - MTH10539

Module designation	Advanced Linear Programming
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Assoc. Prof. Nguyen Le Hoang Anh
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Problem lecture with a multimedia presentation

Workload (incl. contact hours, self-study hours)	150 Hours Contact hours: Lectures: 60 hour *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	LINEAR PROGRAMMING
Module objectives/intended learning outcomes	This course provides fundamental knowledge about interior point methods in solving linear programming problems. - Knowledge: Get familiar with concepts in linear programming models and interior point methods: the ellipsoid method, the central path. - Skills & competences: Describe and use programming tools to solve linear programming problems using the interior point methods. - Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics: 1. Basic properties of linear programs 2. Ellipsoid method 3. Interrior point methods
Examination forms	Midterm and final exam: written exams
Study and examination requirements	+ Class-attendance: at least 70%. + Final score is greater or equal to 5.0/10.0
Reading list	1. Phan Quốc Khánh, Trần Huệ Nương, *Quy hoạch tuyến tính*, NXB Giáo Dục, 2003. 2. D. Bertsimas, J.N. Tsitsiklis, *Introduction to Linear Optimization*, Athena Scientific, 1997. *3.* Roos C., Terlaky T., Vial J., *Theory and algorithms for linear optimization: an interior point approach*, Wiley, 1998

11. Nonsmooth Optimization: Theory and Numerical methods - MTH10540

Module designation	Nonsmooth Optimization: Theory and Numerical Methods
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Assoc. Prof. Nguyen Le Hoang Anh
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture

Workload (incl. contact hours, self-study hours)	150 Hours Contact hours: Lectures: 60 hour *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	This course provides fundamental knowledge about algorithms for nonlinear optimization problems. - Knowledge: get familiar with basic concepts of nonsmooth optimization: convex function, affine function, support function, subdifferential, dual function. - Skills & competences: describe and apply some algorithms in nonsmooth optimization: steepest descent direction, approximately subdifferentials, Bundle method. - Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics: 1. Preliminaries 2. Steepest descent direction 3. Approximately subdifferentials. 4. Bundle method 5. Proximal point method
Examination forms	Midterm and final exam: written exams
Study and examination requirements	+ Class-attendance: at least 70%. + Final score is greater or equal to 5.0/10.0
Reading list	1. Ledyaev Yu. S., Stern R. J., Clarke F. H., *Nonsmooth analysis and control theory*, Springer New York, 1998. *2.* Zowe Jochem, Outrata Jiri, Kocvara Michal, *Nonsmooth approach to optimization problems with equilibriu constraints: theory applications and numerical result*, Springer New York, 1998. *3.* Shetty C. M, Bazaraa Mokhtar S, *Nonlinear programming: theory and algoriths*, Singapore: J. Wiley, 1990.

12. Game Theory - MTH10541

Module designation	Game Theory
Semester(s) in which the module is taught	7th semester
Person responsible for the module	MSc. Nguyen Van Thuy
Language	Vietnamese

Relation to curriculum	Elective
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hour *(in class)* Private study: 120 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Introduces the basics of game theory
Content	This module includes the following topics: 1. Some basis definitions. 2. Minimax Theorem 3. 2-person zero-sum games 4. symmetric zero-sum game 5. Indeterminate games, countable strategies, convex-concave games. 6. Non-zero-sum game
Examination forms	Midterm and final exam: written exams
Study and examination requirements	+ Class-attendance: at least 70%. + Final score is greater or equal to 5.0/10.0
Reading list	1. G. Owen, *Game Theory*, Academic Press Inc, 1995. *2.* Bazaraa Mokhtar S, Jarvis John J., Sherali Hanif D., *Linear programming and network flows*, Wiley, 1990.

13. Optimality conditions in nonsmooth Optimization - MTH10544

Module designation	Optimality Conditions in Nonsmooth Optimization.
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Assoc. Prof. Nguyen Le Hoang Anh
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	150 Hours Contact hours: Lectures: 60 hour *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	None

Module objectives/intended learning outcomes	This course provides fundamental knowledge about nonlinear optimization problems. - Knowledge: get familiar with basic concepts of nonsmooth optimization: convex function, conjugate function, directional derivative, subdifferential, optimality conditions for convex and non-convex problems, variational principle, set-valued mapping, normals cone - Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics: 1. Preliminaries 2. Subdifferential 3. Optimality conditions for convex problems 4. Subdifferentials of Lipschitz Functions and lower semicontinuous function. 5. Optimality conditions for nonconvex problems
Examination forms	Midterm and final exam: written exams
Study and examination requirements	+ Class-attendance: at least 70%. + Final score is greater or equal to 5.0/10.0
Reading list	1. W. Schirotzek, *Nonsmooth Analysis*, Springer New York, 2007. 2. F.H. Clarke, V.F. Demyanov and F. Giannessi, *Nonsmooth optimization and related topics*, Springer New York, 1989. *3.* Zowe Jochem, Outrata Jiri, Kocvara Michal, *Nonsmooth approach to optimization problems with equilibriu constraints: theory applications and numerical result*, Springer New York, 1998.

14. Optimal control - MTH10545

Module designation	Optimal Control
Semester(s) in which the module is taught	6th semester
Person responsible for the module	MSc. Cao Nghi Thuc
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	150 Hours Contact hours: Lectures 60 hour *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	None

Module objectives/intended learning outcomes	This course provides fundamental knowledge on Optimal control problem, Pontryagin's maximum principle, Existence and continuity properties of optimal controls.
Content	This module includes the following topics: 1. Introduce the optimal control problem. 2. Conditions for the existence of solutions to the optimal control problem. 3. Pontryagin's maximum principle to solve many kinds of the optimal control problem.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: Vũ Ngọc Phát, *Nhập môn Lý thuyết điều khiển Toán học*, NXB Đại học Quốc gia Hà Nội, 2001. 2. Johannes Jahn, *Vector OPtimization,* Springer,2004

15. Variational methods in Optimum - MTH10614

Module designation	Variational Method in Optimization
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Dr. Vo Si Trong Long
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	150 Hours Contact hours: Lectures: 60 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- General objectives: To be familiar with variational analysis - Specific objectives/course learning outcomes: Knowledge: variational principles; theory of subdifferential, **Techniques of Variational Analysis** • Skills: Train abstract and logical thinking • Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics: Variational Principles Variational Techniques in Subdifferential Theory

	Variational Techniques in Convex Analysis Variational Techniques and Multifunctions
Examination forms	Class discussion; quizzes: Mid-term and Final exam: Written exam (closed - book).
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Final score is greater or equal to 5.0/10.0
Reading list	- Main book: **Techniques of Variational Analysis** Jonathan M. Borwein and Qiji J. Zhu

2.2.6. Specialization in Probability and Statistics

1. Advanced Probability - MTH10423

Module designation	Advanced probability
Semester(s) in which the module is taught	5th and 7th semester
Person responsible for the module	Prof. Dang Duc Trng
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	Total: 150 hours Contact hours: lectures 60 hours *(in-class)*. Private study: 90 hours *(self-study)*.
Credit points	4 Credits/ 6 ETCS
Required and recommended prerequisites for joining the module	Measure theory and probability, Analysis A1, Analysis A2
Module objectives/intended learning outcomes	The course provides a deeper understanding of the foundations of probability theory, such as probability theory from a measure-theoretic perspective, convergence of distributions and probability measures, Borell-Cantelli lemma, Radon-Nikodym theorem, Fubini theorem, and general central limit theorems.
Content	Probability space; axiomatics. Random variables and vectors; probability distribution; mathematical expectation, integrability, monotone and dominated convergence. Moments and inequalities. Characteristic function, positive definiteness; the Parseval relation; continuity theorem. Independence (classes, sequences, …); the zero – and – one law. Strong law of large number Conditional expectation and distribution. Central limit theorems.
Examination forms	Writing (Midterm: 30%, Final exam: 70%)
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	[1] Nguyễn Bác Văn, Xác suất và xử lý số liệu thống kê, TP Hồ Chí Minh, NXB Giáo dục 1997. [2] Billingsley, P. (1968). Convergence of Probability Measures. Wiley. [3] William Feller, An Introduction to Probability Theory and Its Applications, Vol. II, 2nd ed., New – York, Wiley, 1971. [4] Michel Loève, Probability Theory, 3rd. Ed., New – York, Van Nostrand, 1963.

2. Advanced mathematical Statistics- MTH10424

Module designation	Mathematical Statistics
Semester(s) in which the module is taught	5th and 7th semester
Person responsible for the module	Dr. Hoàng Văn Hà
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, do exercises, group work
Workload (incl. contact hours, self-study hours)	Total: 150 hours Contact hours: Lectures 60 hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Mathematical statistics, Analysis A1, A2
Module objectives/intended learning outcomes	The course in Advanced Mathematical Statistics is designed to provide students with a deep and comprehensive understanding of advanced statistical concepts and methodologies. Beginning with an exploration of statistical structure and the general density function, students will delve into the intricacies of sufficient statistics, including their conditional distribution and the factorization criterion. The course emphasizes the use of sufficient statistics for enhancing the precision of estimates.
Content	Statistical structure. General density function. Sufficient statistics; conditional distribution given sufficient statistics; the factorization criterion; improvement of estimates through sufficient statistics. Statistical estimation; Rao-Crammer inequality; Fisher's information. Efficient estimate. Asymptotic estimators. Estimation methods. Likelihood. Hypothesis testing; Neyman-Pearson lemma. Composite alternative; uniformly most powerful test. Monotone likelihood ratio family. Confidence sets.
Examination forms	Writing (Assignments: 10%, Midterm: 30%, Final exam: 60%)
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	[1] S.Zacks, The theory of Statistical inference, New-York, Wiley, 1971. [2] C.R.Rao, Linear statistical inference and its applications, New-York, Wiley, 1973. [3] E.lehmann, Testing statistical hypotheses, New-York, Wiley, 1959. [4] Nguyễn Bác Văn, Xác suất và xử lý số liệu thống kê, TP. Hồ Chí Minh, NXB Giáo dục, 1997.

3. Multivariate Statistics Analysis - MTH10619

Module designation	Multivariate Statistical Analysis
Semester(s) in which the module is taught	6th and 8th semester
Person responsible for the module	Dr. Nguyễn Thị Mộng Ngọc
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, do exercises, group work, lab works
Workload (incl. contact hours, self-study hours)	Total: 165 hours Contact hours: Lectures 45 hours *(in class)* + 30 lab works hours Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Linear algebra, Mathematical statistics
Module objectives/intended learning outcomes	Equip students with the knowledge base of multidimensional statistical system processing. Apply multivariate skills and "hands-on" techniques using R ou Python software in analyzing real data.
Content	Multivariate normal distribution, Inference about a mean vector (Hotelling's T^2 and Likelihood Ratio Tests, Confidence regions and simultaneous comparisons of Component Means, multivariate quality Control Charts, …); comparisons of several multivariate means (Comparing Mean Vectors from two population, One-Way MANOVA, Two-Way MANOVA, Testing for Equality of Covariance Matrices), Principal Components Analysis (PCA). Apply multivariate skills and "hands-on" techniques using R (ou Python) software in analyzing real data.
Examination forms	Writing
Study and examination requirements	Mid-term: 50%, Final exam: 50%.
Reading list	[1] Applied Multivariate Statistical Analysis, Richard A. Johnson, Dean W. Wichern , 2007. [2] An Introduction to Multivariate Statistical Analysis, T. W. Anderson, 2003. [3] Applied Multivariate StatisticalAnalysis, Wolfgang Härdle · Léopold Sima, 2007. [4] Applied Multivariate Statistics with R, Daniel Zelterman, 2015. [5] An R and S-PLUS Companion to Multivariate Analysis, Everitt, B.S. 2005

4. Stochastic processes - MTH10426

Module designation	Stochastics processes
Semester(s) in which the module is taught	6th and 8th semester
Person responsible for the module	Dr. Le Thi Xuan Mai
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Vietnamese
Workload (incl. contact hours, self-study hours)	Compulsory
Credit points	Lectures
Required and recommended prerequisites for joining the module	Total: 150 hours Contact hours: lectures 60 hours *(in-class)*. Private study: 90 hours *(self-study)*.
Module objectives/intended learning outcomes	The course aims to equip students with the knowledge and skills necessary to analyze and model random processes encountered in various fields, such as finance, engineering, and natural sciences. Students will gain a deep understanding of different stochastic processes and their applications, allowing them to make informed decisions and predictions in situations involving uncertainty and randomness.
Content	Lesson 0: Review of probability and conditional expectation Lesson 1: The Poisson process and related processes Lesson 2: Renewal processes Lesson 3: Discrete Markov chains Lesson 4: Continuous time Markov chains Lesson 5: Martingales Lesson 6: Brownian motion Lesson 7: Stochastic integration
Examination forms	Writing (Midterm: 30%, Final exam: 70%)
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	[1] Introduction to probability models. Sheldon M. Ross, Academic Press, 2019. [2] Stochastic processes. Sheldon M. Ross, Cambridge University Press, 2013. [3] Stochastic Processes and their Applications. P. W. Jones and P. Smith, Chapman and Hall/CRC, 2005. [4] Brownian Motion and Stochatic Calculus. Ioannis Karatzas and Steven E. Shreve, Springer, 1991.

5. Probability and Statistics Seminar - MTH10508

Module designation	Probability and Statistics Seminar
Semester(s) in which the module is taught	Both 7th and 8th semester
Person responsible for the module	Prof. Dang Duc Trong, Dr. Hoang Van Ha, Dr. Nguyen Thi Mong Ngoc, Dr. To Duc Khanh
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Project, seminar
Workload (incl. contact hours, self-study hours)	Total workload: 240 hours. Contact hours: 120 hours. Private study including examination preparation, specified inhours: 120 hours.
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Successfully completed 124/134 Credits
Module objectives/intended learning outcomes	After completing the course, students will be able to: - Point out the research problems in probability/statistics. - Apply fundamental knowledge and theories to analyse theresearch problem; develop a research framework (model if applicable); and design a solution for the problem. - Use appropriate techniques for solutions. - Demonstrate the scientific contribution and practical relevance of the research carried out. - Provide a consistent, well-structured report- Plan and manage learning process. - Present and defend results of the project at the students' seminar.
Content	Various topics.
Examination forms	Essay, oral presentation.
Study and examination requirements	Minimum attendance at weekly meeting is 80%. Final defense is required. Final score is greater or equal to 5.0/10.0
Reading list	Depending on the research topics and supervisor. ß

6. Introduction to Biostatistics - MTH10510

Module designation	**Introduction to Biostatistics**
Semester(s) in which the module is taught	Both 5th and 7th semester
Person responsible for the module	Dr. To Duc Khanh
Language	Vietnamese

Relation to curriculum	Optional
Teaching methods	Lecture, group work
Workload (incl. contact hours, self-study hours)	120 Hours Contact hours: Lectures: 60 hour *(in class, computer lab)* Private study: 60 hours *(self-study)*
Credit points	3 Credits / 5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	The course aims to enable students to acquire, through the discussion of case studies, statistical methods for analysing data for research in the biosciences. - Knowledge: Understand basic types of biological research, as well as how to translate to statistical questions. Mastering the corresponding data types in biological research, as well as appropriate analytical methods. - Skills & competences: Through laboratory activities, the course also provides the necessary tools for the computer application of the statistical methods addressed in the course, using the R statistical software. Through laboratory activities and group work, the student will be able to: • recognize and appropriately describe the case study; • identify the appropriate analysis methodology and tools; • increase sensitivity and criticality in the use of statistical methods with regard to experimental studies; • work in a group; • develop analytical skills and independent judgment; • develop communication skills.
Content	This module includes the following topics: 1. Introduction to biostatistics. 2. Descriptive statistics. 3. Statistical inference for means. 4. Analysis of variance. 5. Statistical inference for categorical data. 6. Risk analysis. 7. Applied linear regression models. 8. Applied logistic regression. 9. Introduction to survival analysis.
Examination forms	Midterm exam: written exams. Final exam: project.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.

Reading list	References: 1. Michael C. Whitlock, Dolph Schluter, *The analysis of Biological data*, Macmillan Learning, 2020. 2. Myra Samuels, Jeffrey Witmer, Andrew Schaffner, *Statistics for the Life Sciences*, Pearson Education, 2016. 3. Harvey Motulsky, *Intuitive Biostatistics: A Nonmathematical Guide to Statistical Thinking,* Oxford University Press, 2017. 4. Julien I. E. Hoffman, *Basic biostatistics for medical and biomedical practitioners*, Academic Press, 2019 5. Hadley Wickham, Garrett Grolemund, *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data*, O'Reilly Media, Inc., 2016.

7. Linear statistical models - MTH10511

Module designation	**Linear statistical models**
Semester(s) in which the module is taught	5th and 7th semester
Person responsible for the module	Dr. Nguyễn Thị Mộng Ngọc
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, do exercises, group work
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: Lectures: 75 hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Linear algebra, Mathematical statistics
Module objectives/intended learning outcomes	Equip students with the knowledge base of linear statistical models, build best-fitting model to data. Apply skills and "hands-on" techniques using R or Python software in analyzing real data.

Content	The course provides knowledge about regression analysis (in-depth analysis of multiple linear regression models), analysis of variance (ANOVA) 1 factor, 2 factors. Selecting the best-fitting model (optimal selection criteria, methods of selecting the best-fitting model: method of selecting the best subset, method stepwise selection, shrinkage method, dimensionality reduction method - principal components regression, PCR). Additionally, checking the assumptions of the model; identify and process multicolinearity; transformation of the response and prediction variables to produce a model that better fits the data.
Examination forms	Midterm and Final exam: written.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. A.C. Rencher, G. B. Schaalje, Linear Models in Statistics, John Wiley & Sons, 2008. 2. N.H. Bingham, John M. Fry, Regression Linear Linear Models in Statistics, Springer, 2010. 3. Sanford Weisberg, Applied Linear Regression, John Wiley & Sons, 2014. 4. Samprit Chatterjee, Ali S. Hadi, Regression Analysis by Example, John Wiley & Sons, 2006. 5. Simon J. Sheather, A Modern Approach to Regression with R, Springer, 2009.

8. Statistics In Economics - MTH10512

Module designation	Statistics In Economics
Semester(s) in which the module is taught	5th semester
Person responsible for the module	MSc. Nguyễn Văn Thìn
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	135 hours Contact hours: Lectures: 45 hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	3 Credits / 5 ECTS
Required and recommended prerequisites for joining the module	Recommended prerequisites: Mathematical statistics

Module objectives/intended learning outcomes	This course provides fundamental knowledge on theory and application of statistics in economics. - Knowledge: get familiar with basic concepts in theory of and application of statistics in economics, supporting future advance courses. - Skills & competences: cognitive and practical abilities to use these knowledges in economics problems.
Content	This course focuses on techniques for estimating regression models, on problems encountered in estimating, and on interpreting the estimates from such models. The goal of the course, based on statistical methods, provides the basics of the theory and practice of econometrics, and makes students become familiar with evaluating the economic models with actual data.
Examination forms	Midterm and final exam: written.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 1. Jeffrey M. Wooldridge, Introductory Econometrics – A Modern Approach, 3ed. References: 1. Berndt, E.R., The Pratics of Econometrics: Classic and Contemporary, Reading et all.: Addison-Wesley, 1991. 2. Cuddy, J.D.A (1974), Quantative methods in Economics: An introduction to statistical inference estimation and modelling, Rotterdam University Press. 3. Dickey, David A. and W.A. Fuller (1979), Distribution of the Estimators for Autoregressive Time Series with aUnit Root", Journal of American Statistical Association, LXXIV, 423-31. 4. Fuller, W.A (1976), Introduction to Statistical Time Series, New York, John Wiley. 5. Granger, C.W.J and P.Newbold (1974), Spurious Regression in Econometrics", Journal of Econometrics, 2 111-120. 6. Hylleberg, S. and Mizon, G.E. (1989), "Cointegation and Error Corection Mechanism", The Economic Journal, 99 113-125. 7. IMF (various issues), Direction of Trade Statistics, Washinton, D.C. : International Money Fund. 8. IMF (various issues), International Financial Statistics, Washington, D.C.International Money Fund. 9. Maddala, G.S (1992), Introduction to Econometrics, Macmillan Publishing Company, New York.

9. Statistical Data Processing - MTH10513

Module designation	Statistical Data Processing
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Dr. Nguyen Dang Minh
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hours (in class) Private study: 120 hours (self-study)
Credit points	3 Credits/ 5.0 ETCS
Required and recommended prerequisites for joining the module	Measure theory and probability, Mathematical statistics
Module objectives/intended learning outcomes	General objective: Equip students with basic knowledge about handling statistical data in a basic way, so that they can more easily approach problems in Data Analysis, Computer Vision. - Specific objectives/course output standards: • Knowledge: Know the form of digital data, audio, images... • Skills: Can use software to manipulate data on… • Attitude, diligence: go to class and complete all assignments, self-study, self-practice...
Content	The course helps students to handle basic data in dataframe, image, video and audio waveforms with libraries in Python such as pandas, open cv, seaborn, ... Some subjects are related in the program: multidimensional statistics, big data, image processing...
Examination forms	Midterm and final exam: written exams
Study and examination requirements	Minimum attendance at lectures is 80% (Absences must not exceed 3 times for the entire duration of the lectures) Final score is greater or equal to 5.0/10.0
Reading list	1. Wolfgang Härdle and Léopold Simar, *Applied Multivariate Statistical Analysis*, Springer Cham, 2019. 2. PyData Development Team, *Pandas: powerful Python data analysis toolkit*, Wes McKinney, 2022.

10. Bayesian Statistics - MTH10514

Module designation	Bayesian Statistics
Semester(s) in which the module is taught	6th and 8th semester
Person responsible for the module	Dr. Lê Thị Xuân Mai
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, lab works
Workload (incl. contact hours, self-study hours)	Total: 150 hours Contact hours: Lectures 60 hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Probability and measures, Analysis 1A, Analysis 2A
Module objectives/intended learning outcomes	- Knowledge: This module will give students some basic knowledge about Bayesian statistics, especially Bayesian inferences for some common distributions and Bayesian linear regression. -Skills & competences: Ability to give Bayesian inference for binomial distribution, Poisson distribution, univariate and multivaritate normal distribution. Learner can do Monte Carlo simulation and Gibb sampling and Bayesian linear regression.
Content	Chapter 1. Belief, probability and exchangebility. Chapter 2. Binomial and Poisson models. Chapter 3. Monte Carlo simulations. Chapter 4. Gibb sampling. Chapter 5. Univariate normal model. Chapter 6. Multivariate normal model. Chapter 7. Linear regression
Examination forms	Writing (Midterm: 30%, Final exam: 70%)
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	[1] Peter D.Hoff. A first course in Bayesian Statistical Methods. Springer. [2] William M. Bolstad. Introduction to Bayesian statistics. Wiley&Sons, 2004. [3] Andrew Gelman et all. Bayesian data analysis. Chapman & Hall, 2004. [4] Jim Albert. Bayesian computation with R. Springer,

	2007. [5] Ross Sheldon M. - Introduction to Probability Models (7th ed. 2007)

11. Nonparametric Statistics - MTH10515

Module designation	**Nonparametric Statistics**
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Prof. Dr. Dang Duc Trong
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lectures and lab works
Workload (incl. contact hours, self-study hours)	Total: 150 hours Contact hours: Lectures 60 hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Recommended prerequisites: Probability theory, Statistics theory, Calculus
Module objectives/intended learning outcomes	This course provides fundamental knowledge on theory of nonparametric statistics. The course helps students build non-parametric estimators, prove the consistence of the estimators, and select the parameters of the estimators
Content	This module includes the following topics: 1. Estimation of cumulative distribution functions. 2. Nonparametric regression. 3. Estimation of probability density functions.
Examination forms	Midterm exam: written exam. Final exam: written exam.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.
Reading list	Main textbook: Larry Wasserman, All ofNonparametric Statistics, Springer, 2006. References: [1] P. Billingsley, *Probability and measure*, 3rd edition, John Wiley & Sons, 1995. [2] A.B. Tsybakov, *Introduction to Nonparametric Estimation*, Springer, 2008.

12. Basic probability theory - MTH10516

Module designation	**Basic Probability Theory**
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	MSc. Nguyễn Văn Thìn
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	150 hours Contact hours: lectures 60 hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Recommended prerequisites: Calculus 1A
Module objectives/intended learning outcomes	This course provides fundamental knowledge on theory of probability. Probability is the science studying phenomenon with random effects. - Knowledge: get familiar with basic concepts in theory of probability, supporting future advance courses. - Skills & competences: cognitive and practical abilities to use these knowledges in real life problems.
Content	Basic concepts in probability: trial, event, definitions and properties of probability, Bayes theorem. Random variable, random vector: the characteristics, marginal distribution, conditional distribution, conditional expectation, independence, covariance, correlation. Central limit theorems.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 1. Marcel B. Finan, A Probability Course for the Actuaries - A Preparation for Exam P/1, 2013. 2. S. M. Ross, A First Course in Probability, 8th Edition, Prentice Hall, 2010. References: 1. Nguyễn Bác Văn. Xác suất và xử lý số liệu thống kê. NXB Giáo dục, TP. Hồ Chí Minh, 1996. 2. Tô Anh Dũng. Lý thuyết xác suất và thống kê toán. NXB ĐHQG TP. Hồ Chí Minh, 2007. 3. Feller W. An Introduction to Probability Theory and Its Applications, Vol. I, II, 2nd ed., NewYork, Wiley, 1971.

13. Sampling Theory - MTH10517

Module designation	**Sampling Theory**
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Dr. Nguyễn Tiến Đạt
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lectures and lab works
Workload (incl. contact hours, self-study hours)	Total: 165 Hours Contact hours: Lectures 45 hour + 30 hours lab works *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Recommended prerequisites: Measure theory and probability; Mathematical Statistics.
Module objectives/intended learning outcomes	This course provides fundamental knowledge on theory of sampling in statistics. Sampling procedures (for collecting data) relating to many statistical techniques are used in various fields in social science, marketing, public health, etc. - Knowledge: to understand and get familiar with basic concepts in theory of sampling in statistics. - Skills & competences: cognitive and practical abilities to use this knowledge along with statistical software to design statistical sampling procedures.
Content	This module includes the following topics: 1. Review on basic concepts in sampling in statistics. 2. Probability sampling. 3. Stratified sampling. 4. Ratio estimation and regression estimation 5. Cluster sampling with equal probabilities. 6. Sampling with unequal probabilities. 7. Complex surveys and nonresponse issue in survey. 8. Categorical Data Analysis in complex surveys. 9. Two-phase sampling. 10. Some other topics: estimating the size of a population; rare populations and small area estimation.
Examination forms	Midterm exam: written exam. Final exam: group projects.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.
Reading list	Main textbook: Sharon L. Lohr, *Sampling: Design and Analysis*, 3rd Ed. CRC Press Chapman & Hall, 2022. References: Steven K. Thompson, Sampling, 3rd Ed., Wiley, 2012.

14. Time Series - MTH10485

Module designation	Time Series
Semester(s) in which the module is taught	6th , 8th semester
Person responsible for the module	MSc. Nguyen Thi Hong Nhung
Language	Vietnamese
Relation to curriculum	Optional
Teaching methods	Lecture, do exercise, group work
Workload (incl. contact hours, self-study hours)	Total: 165 hours Contact hours: Lectures 60 hour *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Recommended prerequisites: Measure Theory and Probability (MTH10401) and Mathematical Statistics (MTH10404)
Module objectives/intended learning outcomes	The objective of the course is to learn and apply statistical methods to analysis data observed over time and the ARIMA process. Students can identify the ARMA process for a given data set and use R software to analysis time series and make predictions. - Knowledge: An introduction to time series analysis in the time domain. - Skills & competences: Students can identify the ARMA process for a given data set and use R software to analysis time series and make predictions.
Content	Topics will include: Stationarity, autocorrelation functions, autoregressive moving average models (ARMA), partial autocorrelation functions, forecasting, seasonal ARIMA models, parametric spectral estimation.
Examination forms	Lab/ Assignments, Project Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0. + Assignments: 15%+ Project: 20%+ Midterm: 15%: Final: 50%
Reading list	Main textbook: • Time Series Analysis and its Applications. With R examples, Robert H.Shumway and Davis S.Stoffer, Springer, 4th Edition, 2016. References:

	1. Time Series: A Data Analysis Approach Using R, , Robert H.Shumway and Davis S.Stoffer,CRC Press/Chapman &Hall, 2019. 2. Practical Time Series Analysis, Dr. Avishek Pal, Dr.PKS Prakash, Packt Publishing Ltd, 2017.

15. Functional Analysis in Statistics - MTH10518

Module designation	**Functional Analysis in Statistics**
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Prof. Dr. Dang Duc Trong
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lectures
Workload (incl. contact hours, self-study hours)	Total: 150 hours Contact hours: Lectures 60 hours *(in class)* Private study: 90 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Recommended prerequisites: Probability theory, Statistics theory, Functional Analysis
Module objectives/intended learning outcomes	This course provides fundamental knowledge on theory of function spaces and martingale theory.
Content	This module includes the following topics: 1. Lp spaces, 2. Convergence of sequence of random variable 3. Conditional Expectation 4. Martiagale and convergence theorems
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: Jean Jacob, Philip Protter, Probability Essentials, Springer, 2005 References: P. Billingsley, *Probability and measure*, 3rd edition, John Wiley & Sons, 1995.

16. Nonparametric Tests - MTH10609

Module designation	Nonparametric Test
Semester(s) in which the module is taught	6th and 8th semester
Person responsible for the module	Dr. Lê Thị Xuân Mai
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 practical lessons in laboratory. Private study: 90 hours *(self-study)*.
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Mathematical Statistics
Module objectives/intended learning outcomes	- Knowledge: This module will give students some basic knowledge about statistic tests by using nonparametric methods. Nonparametric test is a replacing method for the small samples or for the case the data don't satisfy some conditions of the parametric tests. -Skills & competences: Ability to test the median of a population or compare two medians of two populations.
Content	Chapter 1. Order statistics and ARE coefficient. Chapter 2. Sign test. Chapter 3. The Wilcoxon signed rank test Chapter 4. Mann Whitney U test Chapter 5. The Wilcoxon rank-sum test Chapter 6. Krusal Wallis test
Examination forms	Midterm and Final exam: written.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.

Reading list	[1] Jean Dickinson Gibbons and Subhabrata Chakraborti. Nonparametric Statistical Inference, 5th edition, Chapman and Hall,2010. [2] James J Higgins. An introduction to Modern Nonparametric statistics, London: Thomson Learning, c2004. [3] Wayne W. Daniel. Applied Nonparametric statistics, Boston: PWS-Kent Publishing,1990.

2.2.7. Specialiation in Data Science

1. Introduction to Database systems - MTH10312

Module designation	Introduction To Database Systems
Semester(s) in which the module is taught	5th semester
Person responsible for the module	MSc. Nguyễn Hiền Lương
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, lab works
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6.5 ETCS
Required and recommended prerequisites for joining the module	Recommended prerequisites: Basic Computing Skills
Module objectives/intended learning outcomes	Introduce students to basic concepts of databases; data models; database design standards and standard forms.
Content	- Basic concepts of databases. - Linked entity data model, relational data model. - Operations on the relational data model. - SQL query language. - Standard forms and normalization algorithms for databases.
Examination forms	Midterm and final exam: written exam
Study and examination requirements	Mid-term: 30%, Final exam: 70% Final score is greater or equal to 5.0/10.0
Reading list	[1] R. Elsmari, S. Navathe. Fundamentals of Database Systems 4th edition, Addison Wesley, 2004. [2] Nguyễn Kim Anh, Nguyên lý của các hệ cơ sở dữ liệu, NXB ĐHQG Hà Nội, 2004.

2. Introduction to artificial intelligence - MTH10318

Module designation	Introduction To Artificial Intelligence
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Assoc. Prof. Nguyễn Thanh Bình
Language	Vietnamese
Relation to curriculum	Compulsory

Teaching methods	Lecture, lab works
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	Required: + Data structures and algorithms, + Discrete mathematic Recommended: Practical Laboratory
Module objectives/intended learning outcomes	The course provides some basic knowledge of artificial intelligence science. The main content including Problem solving methods and applications. Focus on heuristic methods. Presenting some knowledge representation methods and some knowledge processing techniques. The problem of approximate reasoning. Introduction to some knowledge systems. Introduce some other models and methods. Ontology and Agent Concepts. At the same time, the course also introduces soft computing techniques such as Fuzzy, Neural networks, genetic algorithms.
Content	- Overview of the science of AI - State space and the search problem - Knowledge demonstration - Introduction to machine learning and knowledge discovery - Introducing Ontology and Intelligent Agent - Introduction to Genetic Algorithms (GA) - Introducing Fuzzy Logic - Neural Network
Examination forms	Midterm and final exam: written exam
Study and examination requirements	- Do theoretical and practical exercises (40%). - Final exam (60%). Final score is greater or equal to 5.0/10.0
Reading list	[1]. Artificial intelligence: problem solving methods and knowledge processing techniques, Nguyen Thanh Thuy, 1996, Education Publishing House [2]. How to solve a math problem on a computer (1, 2, 3), Hoang Kiem, 2004, Education Publishing House [3]. Artificial Intelligence, Dinh Manh Tuong, 2002, Science and Technology Publishing House [4]. Machine Learning, Nguyen Dinh Thuc, 2002, Social Labor Publishing House [5]. Evolutionary Programming, Nguyen Dinh Thuc, 2001, Education Publishing House

	[6]. Noron network methods and applications, Nguyen Dinh Thuc, 2000, Education Publishing House [7]. Fuzzy control theory, Phan Xuan Minh, Nguyen Doan Phuoc, Science and Technology Publishing House [8]. Fuzzy and Applied Logic, Dang Thanh Ha, B. Bouchon Meunier, Ho Thuan, 2007, Hanoi National University Publishing House [9]. Agent-oriented software engineering, Le Tan Hung, Tu Minh Phuong, Huynh Quyet Thang, 2006, Science and Technology Publishing House [10]. Artificial Intelligence A Modern Approach, Stuart J. Russell, Peter Norvig, 1995, Prentice Hall

3. Introduction to machine learning - MTH10353

Module designation	Introduction To Machine Learning
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Dr. Huỳnh Thế Đăng
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, lab works, project
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6.5 ETCS
Required and recommended prerequisites for joining the module	Probability and Statistics Higher algebra
Module objectives/intended learning outcomes	Students will be provided with basic knowledge of Machine Learning including: decision trees, artificial neural networks, genetic algorithms, statistical theory of hypothesis testing and Bayes, ... From that students can learn more deeply about machine learning models such as association classifiers, clustering, Bayesian networks, ... These are necessary knowledge to serve the scientific research work of students in the future.
Content	a. Closed and open Leontief model, direct and indirect costs b. Labor theory of value, substitution theorem c. Linear optimal model, producible set, efficient production, production constraints, consumption d. Nonlinear optimization model, modern theory of demand, extended theory of production

	e. Equilibrium in the market economy, budget constraints, Walras-Wald model, Arrow-Debreu-Mckenzie model f. Equilibrium growth in dynamic economic model, Leontief model, Von Neumann model, equilibrium growth model
Examination forms	Final exam: written exam
Study and examination requirements	Project: 15% Final exam: 75%.
Reading list	Mandatory: 1. Lecture and slides provided by the lecturer. 2. Tom Mitchell, Machine Learning, McGraw Hill, Second Edition.

4. Statistical Data Processing - MTH10513

(see description of this module in Specialization in Probability and Statistics)

5. Data Mining - MTH10358

Module designation	Data Mining
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Assoc. Prof. Nguyễn Thanh Bình
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	Basic programming
Module objectives/intended learning outcomes	After successfully completing this course, students will be able to: • Analyze data and carry out the steps of the data mining process • Understand and apply data mining algorithms and tools that can be used to assist data analysts and data mining application developers • Explain common data mining tasks such as regression, classification, clustering, and association rule mining • Participate in advanced research to improve existing algorithms for each specific problem in data mining.

Content	This course is intended to introduce the knowledge mining process, concepts, technologies, and applications of data mining. In addition, this course also covers data preprocessing problems, data mining tasks, algorithms, and data mining tools that can be used to assist data analysts and analysts. Data mining application development. Subject-specific topics including overview of data mining, data mining problems, data preprocessing problems, data regression, data classification, clustering data mining, association rule mining, data mining application development, and advanced research topics in data mining.
Examination forms	Midterm and final exam: written exams
Study and examination requirements	Midterm: 30% Final exam: 70% Final score is greater or equal to 5.0/10.0
Reading list	[1] Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", Third Edition, Morgan Kaufmann Publishers, 2012. [2] David Hand, Heikki Mannila, Padhraic Smyth, "Principles of Data Mining", MIT Press, 2001 [3] David L. Olson, Dursun Delen, "Advanced Data Mining Techniques", Springer-Verlag, 2008. [4] Graham J. Williams, Simeon J. Simoff, "Data Mining: Theory, Methodology, Techniques, and Applications", Springer-Verlag, 2006.

6. Python for Data Science - MTH10605

Module designation	Python for Data Science
Semester(s) in which the module is taught	6th semester
Person responsible for the module	MSc. Hà Văn Thảo
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	Python programming

Module objectives/intended learning outcomes	- General objective: To present basic knowledge of python programming for data science for multidimensional signal data processing in data classification or object recognition, data mining, data analysis, statistics, machine learning, …. The main content of the program will present the basis for students to be able to program in python in data science. Then students will apply the knowledge to solve large problems. - Specific objectives/course output standards: • Knowledge: Master the basics of python programming • Skills: analyzing and applying algorithms in practice • Attitude, diligence: have the right attitude, opinion, and awareness about the subject
Content	This module includes the following topics: 1. Introduction to Python Programming 2. Control structure 3. Function 4. Data structures in Python 5. Object-oriented programming 6. Support libraries
Examination forms	Midterm and final exam: written exams
Study and examination requirements	Class-attendance: 5% Practices and exercises: 5% Midterm exam: 20% Final exam: 70% Final score is greater or equal to 5.0/10.0
Reading list	Main textbook: 1. Paul Deitel & Harvey Deitel, Intro to Python for Computer Science and Data Science, Pearson. 2022. 2. Guido van Rossumand the Python development team, Python Tutorial, Odense Universitet, Institut for Matematik og Datalogi, 2018. References: 3. Rajeev Ratan, Data Science & Deep Learning for Business, Udemy, 2022. 4. tensorflow.org, tensorflow, https://www.tensorflow.org/tutorials, 2019. 5. keras.io, keras, https://keras.io/, 2019. 6. Scikit-learn.org, scikit-learn, https://scikit-learn.org/stable/tutorial/index.html, 2019

7. Pattern Recognition – MTH10322

Module designation	Pattern Recognition
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Dr. Trần Anh Tuấn
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, lab works
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Programming Techniques
Module objectives/intended learning outcomes	Introduces the mathematical foundations of pattern recognition with examples from a variety of applications. Multidimensional data processing techniques, classification, and regression algorithms as well as data clustering will be presented. Students and graduate students interested in pattern recognition, artificial neural networks, SVM (support vector machine) and computer vision can participate in this module.
Content	1. Statistical methods in pattern recognition 2. Parameter Estimation 3. Supervised learning 4. Un-supervised learning
Examination forms	Midterm and final exam: written exam
Study and examination requirements	Class-attendance: 5% Practices and exercises: 5% Midterm exam: 20% Final exam: 70% Final score is greater or equal to 5.0/10.0
Reading list	Mandatory: Slides and lectures. References: [1] R. O. Duda, P. E. Hart and D. Stork, Pattern Classification (2nd Ed.), Eiley 2002. [2] C. Bishop, Pattern Recognition and Machine Learning, Springer 2006. [3] T. Hastie, R. Tibshirani, J. Friedman, The Elements of Statistical Learning (2nd Ed.), Springer 2009.

8. Multidimensional Signal Processing

Module designation	Multidimensional Signal Processing
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Dr. Kha Tuấn Minh
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Linear Algebra, Statistical and Probability
Module objectives/intended learning outcomes	General objective: Present some basic knowledge about multidimensional signal data processing in data classification or object recognition, data mining, data analysis, statistics, machine learning, etc. The main content of the program will present mathematical ideas of: principal component analysis method, discrete analysis, independent component analysis, non-negative matrices, and some multiplication methods. Students will then apply knowledge to solve major exercises. Specific objectives/subject output standards: + Knowledge: Master the basic knowledge of multidimensional processing + Skills: analyse and apply algorithms in practice + Attitude and diligence: have the right attitude, perspective and awareness about the subject
Content	1. Principal Component Analysis method 2. Discrete analysis 3. Independent Component Analysis method 4. Non-negative matrix factorization 5. Kernel methods 6. Clustering and classification
Examination forms	Midterm and final exam: written exam
Study and examination requirements	Class-attendance: 5% Practices and exercises: 5% Midterm exam: 20% Final exam: 70%

	Final score is greater or equal to 5.0/10.0
Reading list	Mandatory: Slides and lectures. References: [1] Richard O. Duda, Peter Elliot Hart, David G. Stork, Pattern classification, Wiley 2004. [2] Boris Mirkin, Mathematical classification and clustering, Khuwer Academic Publisher 1996. [3] Martin E. Modell, Data analysis, data modelling, and classification, New York : McGraw-Hill 1992.

9. Algorithm analysis – MTH10325

Module designation	Algorithm analysis
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Assoc. Prof. Nguyễn Thanh Bình
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, lab works, practice in groups
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6.5 ETCS
Required and recommended prerequisites for joining the module	Discrete mathematics
Module objectives/intended learning outcomes	Equip students with knowledge and programming skills to evaluate the complexity of algorithms, correctness of algorithms, generating functions and applications; permutations and applications; evaluate some commonly used algorithms.
Content	- Overview of the algorithm and its complexity - Generative functions and applications - Permutations and applications - Evaluate the complexity of some common algorithms
Examination forms	Midterm and final exam: written exam
Study and examination requirements	- Do theoretical and practical exercises in groups (10%). - Midterm written exam (20%). - Final written exam (70%). Final score is greater or equal to 5.0/10.0

Reading list	[1] Kenneth H. Rosen, *Discrete Mathematics and Its Application* , McGraw-Hill, 1998. [2] Herbert S.Wilf, *Algorithm Complexity*, Internet Edition 1994. [3] Herbert S.Wilf, *Generating Functionology*, Internet Edition 1994. [4] Ian Parberry, *Lecture Notes on Algorithm Analysis and Computational Complexity,* Internet Edition 2001.

10. SQL server Database Management system - MTH10344

Module designation	SQL Server Database Management System
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Dr. Trần Anh Tuấn MSc. Nguyễn Hiền Lương
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, lab works
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Introduction to database systems
Module objectives/intended learning outcomes	Students know how to access knowledge about databases and database management systems: components of the SQL Server database management system and their functions, concurrent access management mechanisms, safety and data recovery after incidents, decentralisation and security.
Content	1. Introduction including definition, functions, properties, architecture of database management system, SQL and Microsoft SQL server 2. Fundamental SQL syntaxes 3. Securing SQL server 4. Stored and manage procedures 5. Creating and managing user-defined functions 6. Creating and managing triggers in SQL server
Examination forms	Midterm and final exam: written exam
Study and examination requirements	Class-attendance: 5% Practices and exercises: 5%

	Midterm exam: 20% Final exam: 70% Final score is greater or equal to 5.0/10.0
Reading list	Mandatory: Slides and lectures. References: [1] Dương Quang Thiện, SQL Server 2000: Lập trình T - SQL, NXB Văn hóa Sài Gòn, 2007. [2] Ray Rankins, Paul Bertucci, Chris Gallelli, Alex T. Silverstein, Microsoft SQL Server 2005 Unleashed, Sams Publishing, 2007. [3] Brian Knightet al, Professional SQL Server 2005 Administration, Wrox Press, 2007. [4] Paul Turley & Dan Wood, Beginning Transact-SQL with SQL Server 2000 and 2005, Wrox Press, 2006.

11. Advanced Machine Learning - MTH10354

Module designation	Advanced Machine Learning
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Assoc. Prof. Phạm Thế Bảo
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture and lab work
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: - Lectures: 45 hours, - Labwork: 30 hours Private study: 90 hours (Self-study)
Credit points	4 Credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	Required prerequisite: Introduction to artificial intelligence. Recommended prerequisite: programming skill.
Module objectives/intended learning outcomes	This course provides advanced knowledge of machine learning. - Knowledge: mastering the advanced knowledge of machine learning. - Skills: cognitive and practical abilities to use these knowledge in practical problems. - Attitude: Have the right attitude, perspective and awareness about the subject.

Content	This module includes the following topics: 1. Depth first, Breadth first, complexity, completeness and optimality of search methods, Implementing DFS and BFS, Iterative deepening search 2. Using heuristics for search, hill-climbing, best-first, beam search 3. Optimal paths, Branch and Bound, A* 4. Parallel search, Bi-directional search 5. Games, minimax, Alpha-beta pruning 6. Constraint satisfaction search, Cryptographic problems, Real-time A*, Iterative-deepening A* 7. Knowledge Representation and Reasoning: Building a Knowledge Base: Propositional logic, Predicate logic, Theorem Proving.
Examination forms	Class discussion; mid-term and final term exam: written exam.
Study and examination requirements	Class - attendance: 5%. Discussion, exercises, practices: 5%. Midterm exam: 20% Final theory exam: 70%. Final score is greater or equal to 5.0/10.0
Reading list	- Main books: 1. Tom M. Mitchell, **Machine learning**, 1997. 2. Stuart Russell and Peter Norvig, **Artificial Intelligence: A Modern Approach,** 2010: http://aima.cs.berkeley.edu/python/readme.html - Reference: 3. Trần Trọng Khiêm, **Statistical machine learning approaches to credit risk**, 2015.

12. Multivariate Statistical Analysis - MTH10619

(see description of this module in Specialization in Probability and Statistics)

13. Numerical Method in Optimization - MTH10450

(see description of this module in Specialization in Optimization)

14. Time series - MTH10485

(see description of this module in Specialization in Probability and Statistics)

15. Basic probability theory - MTH10516

(see description of this module in Specialization in Probability and Statistics)

16. Big-data Engineering - MTH10606

Module designation	Big-data Engineering
Semester(s) in which the module is taught	5th and 7th semester
Person responsible for the module	Assoc. Prof. Nguyễn Thanh Bình
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, labwork
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Provides students with foundational knowledge in big data processing. Students will learn basic techniques when handling large volumes of data as well as related databases. In addition, students learn specific applications to apply in future problems.
Content	1. Introduction and overview. Basic knowledge of statistics, R, and Python 2. Types of relationships and representation methods. Non-SQL and SQL Database 3. Graph theory 4. Introduction of Sparks and Foreign languages learning in Sparks 5. Streaming data and introduction of Kafka 6. Introduction of Spark ML libraries. Some applications using Spark ML 7. Search system. Introduction of Page Rank 8. Tensorflow and its applications in real life
Examination forms	Final exam: project
Study and examination requirements	Practices and in class exercises: 50% Final project: 50% Final score is greater or equal to 5.0/10.0
Reading list	Mandatory: Slides and lectures. References: [1] Jeffrey Dean and Sanjay Ghemawat. 2008. MapReduce: simplified data processing on large clusters.

	Commune. ACM 51, 1 (January 2008), 107-113. DOI: https://doi.org/10.1145/1327452.1327492. [2] https://hadoop.apache.org/. [3] http://spark.apache.org/ [4] https://pandas.pydata.org/

17. Data Science Seminar - MTH10620

Module designation	Data Science Seminar
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Depending on the assignment of the Department of Computer Science
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Seminar, project
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Discussion: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Introduction to artificial intelligence.
Module objectives/intended learning outcomes	Learn more deeply about your major with greater self-study under the guidance of a lecturer and prepare to write a graduation thesis. Specific objectives/subject output standards: + Knowledge: provides additional knowledge that is more extensive than the subjects in the major. + Skills: prepare skills for deeper learning and research, such as: self-study, group discussion, writing reports/presentations, arguing/justifying/defending opinions, how to find and use resources related references.
Content	Students will work directly with faculty on a topic. Topic content can be: + Issues that have not been mentioned in the subjects of the major. + Problems arise in specialised subjects but have not been resolved. + The necessary knowledge is not included in the program to prepare for the expected graduation thesis topic.

	The problems of the subject will be assigned by the lecturer for students to explore, research and present. Applicable forms: + Under the guidance of instructors, students choose a topic and register for research tasks, then report back. Instructors analyse and evaluate results. + The lecturer selects and presents the problem. Students present their understanding of that issue.
Examination forms	Final exam: project or representation.
Study and examination requirements	Class-attendance: 15% Discussion and practices: 35% Final exam: 50% Final score is greater or equal to 5.0/10.0
Reading list	Depending on the assigned topic and supervisor.

18. Data visualization - MTH10608

Module designation	Data Visualization
Semester(s) in which the module is taught	5th and 7th semester
Person responsible for the module	Dr. Nguyễn Tấn Trung
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, labwork
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Python programming
Module objectives/intended learning outcomes	Presents basic knowledge of data visualisation for data science for multidimensional signal data processing in data classification or object recognition, data mining, data analysis, and statistical analysis. statistics, machine learning, ... The main content of the program will present how to use tool packages and libraries on python. Students will then apply knowledge to solve major exercises. Presents basic knowledge of data visualisation for data science for multidimensional signal data processing in data

	classification or object recognition, data mining, data analysis, and statistical analysis. statistics, machine learning, ... Specific objectives/subject output standards: Knowledge: Mastering data visualisation libraries in python. Skills: analyse and apply algorithms in practice. Attitude and diligence: have the right attitude, perspective and awareness about the subject.
Content	1.Introduction to Data Visualisation and Matplotlib, basic plotting with them and practising with dataset. 2.Seaborn including Waffle charts, word cloud, Seaborn, Regression plots, introduction to Folium, Maps with Markers and Choropleth Maps. 3.Advanced Matplotlib including Area Plots, Histograms, Bar Charts, Pie Charts, Box Plots and Scatter Plots. 4.Advanced Visualization Libraries including Pandas visualisation, Plotly, and ggplot.
Examination forms	Midterm and final exam: written exam
Study and examination requirements	Class-attendance: 5% Practices and exercises: 5% Midterm exam: 20% Final exam: 70% Final score is greater or equal to 5.0/10.0
Reading list	Mandatory: Slides and lectures. References: [1] Guido van Rossumand the Python development team, Python Tutorial, Python Software Foundation 2018. [2] matplotlib.org, matplotlib, matplotlib.org, 2019. [3] Seaborn, Seaborn, seaborn.pydata.org, 2019.

19. Numerical Methods for Data Science - MTH10607

Module designation	Numerical Methods for Data Science
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Dr. Nguyễn Thị Hoài Thương
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, lab works

Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6.5 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	General objective: Present numerical methods for processing multidimensional signal data in data classification or object recognition, data mining, data analysis, statistics, machine learning, etc. The main content of the program will present mathematical ideas of numerical methods in data science. Students will then apply knowledge to solve major exercises. Specific objectives/subject output standards: + Knowledge: Master the basic knowledge of numerical methods in data science. + Skills: analyse and apply algorithms in practice. + Attitude and diligence: have the right attitude, perspective, and awareness about the subject.
Content	1. Learning theory 2. Linearity 3. Multiplicative weights and online learning 4. Optimization 5. Regression and its analysis 6. Graphical Models 7. Algorithms for massive data sets
Examination forms	Midterm and final exam: written exam
Study and examination requirements	Class-attendance: 5% Practices and exercises: 5% Midterm exam: 20% Final exam: 70% Final score is greater or equal to 5.0/10.0
Reading list	Mandatory: Slides and lectures. References: [1] Boyd S. Vandenberghe L., Convex Optimization, Cambridge 2009. [2] Avrim Blum, John Hopcroft, Ravindran Kannan, Foundations of Data Science, Cambridge University Press 2016.

2.2.8 Specialization in Mathematical Methods in Computer Science

1. Introduction to Artificial Intelligence - MTH10318

(see description of this module in Specialization in Data Science)

2. Introduction to Cryptography - MTH10319

Module designation	Introduction To Cryptography
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Dr. Le Van Luyen
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6.5 ETCS
Required and recommended prerequisites for joining the module	Require: Linear Algebra A1, Higher Algebra, Algorithmic number theory
Module objectives/intended learning outcomes	- Equip students with basic knowledge about classical cryptographic theory, modern symmetric cryptography, public cryptography, cryptographic hash function, digital signature, key exchange protocol. - At the same time, students are strengthened: programming skills through exercises on installing algorithms; skills in research and presentation of open topics; skills in using security software.
Content	- Basic concepts of classical cryptographic theory. - Common symmetric cryptosystems: DES, AES. - Common cryptographic hash functions: MD5, SHA1. - Common public cryptosystems: RSA, ElGamal, ECC. - Diffie-Hellman key exchange protocol - Digital signatures: RSA, DSA, ECC. - Using software: PGP, SSH, Cryptool
Examination forms	Midterm and final exam: written exam
Study and examination requirements	Class-attendance: 5% Practices and exercises: 5% Midterm exam: 20% Final exam: 70% Final score is greater or equal to 5.0/10.0
Reading list	[1] Douglas R. Stinson, Cryptography: Theory and Practice, 3rd. ed., Chapman & Hall/CRC, 2006.

	[2] Alfred J. Menezes, Paul C. van Oorsczyk and Scott A. Vanstone, Handbook of Applied Cryptography , CRC Press, 2001. [3] Pham Huy Dien, Ha Huy Khoai, Information Coding: Mathematical foundations and applications, National University Publishing House, Hanoi, 2003.

3. Digital signal processing - MTH10320

Module designation	Digital Signal Processing
Semester(s) in which the module is taught	4th and 6th semester
Person responsible for the module	MSc. Nguyễn Ngọc Long
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Introduction to the mathematical basis of digital signal processing, frequency representation of a signal as a linear combination of basis functions, classical (Fourier) and modern (wavelet) frequency representations.
Content	This module includes the following topics: 1. Frequency analysis of signals – general theory. 2. Fourier analysis. 3. Wavelet expansion.
Examination forms	Seminar; Final exam: written exams
Study and examination requirements	- Do theoretical and practical exercises in groups (30%). - Seminar (20%). - Final exam (50%). Final score is greater or equal to 5.0/10.0
Reading list	[1] Lawrence R. Rabiner, Bernard Gold, Theory and Application of Digital Signal, Prentice Hall, 1975. [2] Gilbert Strang, Truong Nguyen, Wavelet and Filter bank, SIAM, 1996. [3] James H. McClellan, MA Yoder, Mark Yoder, DSP First: A Multimedia Approach, Prentice Hall, 1998.

4. High Performance Computing - MTH10321

Module designation	High Performance Computing
Semester(s) in which the module is taught	5th and 7th semester
Person responsible for the module	Assoc. Prof. Nguyễn Thanh Bình
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, labwork
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Data structures and algorithms Discrete mathematics Object-Oriented programming
Module objectives/intended learning outcomes	Presents some basic knowledge in parallel programming models, parallel computer architecture, parallel programming models, and parallel computing algorithms.
Content	1. Fundamental definition 2. Parallelism methods 3. Message Passing Interface 4. Parallel programming schemes 5. Parallel algorithm
Examination forms	Midterm and final exam: written exam
Study and examination requirements	Class-attendance: 5% Practices and exercises: 5% Midterm exam: 20% Final exam: 70% Final score is greater or equal to 5.0/10.0

Reading list	Mandatory: Slides and lectures. References: [1] Bertsekas D. & Tsitskilis J., Parallel and Distributed Computation, Prentice Hall 1989. [2] Quinn M., Parallel Computing – Theory and Practice, McGraw Hill, 1994. [3] Joseph JaJa, An Introduction to Parallel Algorithms, Addison – Wesley Publ. 1992. [4] MPI & PVM Standards (Internet). [5] "Scalable Parallel Computing: Technology, Architecture, Programming", Kai Hwang & Zhiwei Xu, McGRAW-HILL, 1997

5. Pattern recognition - MTH10322

(see description of this module in Specialization in Data Science)

6. Arithmetic and Algorithms - MTH10324

Module designation	Arithmetic And Algorithms
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Dr. Trần Nam Dũng
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, project, seminar
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6.5 ETCS
Required and recommended prerequisites for joining the module	Higher Algebra
Module objectives/intended learning outcomes	Equip students with basic knowledge and programming skills of algorithmic arithmetic: prime numbers, congruences, continuous fractions, arithmetic functions, squared remainders, elliptic curves, algorithms deterministic and probabilistic primes testing, integer analysis, and discrete logarithms.
Content	- Recall the basics of algorithms and complexity.

	- Integer representation, prime numbers, Euclidean division algorithm, Chinese remainder theorem, Fermat's theorem, and continuous fractions - Euler nonfunctions, Mersenne primes, primitive roots - Squared residuals, Legendre notation, Jacobi notation - Prime number checking algorithms, prime number analysis - Elliptic curves over real numbers and over finite fields - Apply arithmetic to cryptographic theory: Caesar cipher system, RSA, ElGamal. - Algorithm to calculate discrete logarithms.
Examination forms	Midterm and final exam: written exam
Study and examination requirements	Class-attendance: 5% Practices and exercises: 5% Midterm exam: 20% Final exam: 70% Final score is greater or equal to 5.0/10.0
Reading list	[1] Ha Huy Khoai – Pham Huy Dien, *Algorithmic Arithmetic,* National University Publishing House, Hanoi, 2003. [2] Menezes, Oorschot and Vanstone, *Handbook of Applied Cryptography*, CRC Press, 2001. [3] Allen Downey, Think Python, http://www.thinkpython.com

7. Algorithm analysis - MTH10325

(see description of this module in Specialization in Data Science)

8. Mathematical Methods in Computer Science Seminar - MTH10346

Module designation	Mathematical Methods in Computer Science Seminar
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Depending on the assignment of the Department of Computer Science
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Seminar, project
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Discussion: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Introduction to artificial intelligence, Introduction to Crytography, Algorithm Analysis

Module objectives/intended learning outcomes	Learn more deeply about your major with greater self-study under the guidance of a lecturer and prepare to write a graduation thesis. Specific objectives/subject output standards: + Knowledge: provides additional knowledge that is more extensive than the subjects in the major. + Skills: prepare skills for deeper learning and research, such as: self-study, group discussion, writing reports/presentations, arguing/justifying/defending opinions, how to find and use resources related references.
Content	Students will work directly with faculty on a topic. Topic content can be: + Issues that have not been mentioned in the subjects of the major. + Problems arise in specialised subjects but have not been resolved. + The necessary knowledge is not included in the program to prepare for the expected graduation thesis topic. The problems of the subject will be assigned by the lecturer for students to explore, research and present. Applicable forms: + Under the guidance of instructors, students choose a topic and register for research tasks, then report back. Instructors analyse and evaluate results. + The lecturer selects and presents the problem. Students present their understanding of that issue.
Examination forms	Final exam: project or representation.
Study and examination requirements	Class-attendance: 15% Discussion and practices: 35% Final exam: 50% Final score is greater or equal to 5.0/10.0
Reading list	Depending on the assigned topic and supervisor.

9. Computer vision - MTH10348

Module designation	Computer vision
Semester(s) in which the module is taught	5th and 7th semester
Person responsible for the module	Assoc. Prof. Phạm Thế Bảo
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture and lab work

Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: - Lectures: 45 hours - Lab work: 30 hours Private study: 90 hours (self-study)
Credit points	4 Credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	Required prerequisite: Data Structure Recommended prerequisite: Basic Matlab programming
Module objectives/intended learning outcomes	This course provides basic knowledge of computer vision such as affine geometric, Euclide, mapping and model of camera leading to problems about image restoration, image combination, 3D image construction in stereoscopic vision. - Specific objectives/course learning outcomes: + Knowledge: get familiar with basic knowledge of computer vision. + Skills: cognitive and practical abilities to use this knowledge in practical problems. + Attitude: Have the right attitude, perspective, and awareness about the course.
Content	This module includes the following topics: 1. Introduction to geometric basic 2. One camera model 3. Two cameras and n Cameras model 4. Some algorithms and techniques in image analysis.
Examination forms	Class discussion; Midterm and final exam: written exams
Study and examination requirements	Class attendance: 5%. Discussion, exercises, practices: 5%. Midterm exam: 20% Final theory exam: 70%. Final score is greater or equal to 5.0/10.0
Reading list	- Main textbooks: 1. Karsten Schluns, **Reinhard Klette, Andreas Koschan, Computer vision: three-dimentional data from images**, 1998. 2. Robert J. Schalkoff, **Digital image processing and computer vision**, 1989. - Reference: 3. Alessandro Verri, Emanuele Trucco, **Introductory techniques for 3-D computer vision**, 1998.

10. Introduction to Machine Learning - MTH10353

(see description of this module in Specialization in Data Science)

11. Advanced Machine Learning - MTH10354

(see description of this module in Specialization in Data Science)

12. Mobile computing - MTH10355

Module designation	Mobile Computing
Semester(s) in which the module is taught	5th and 7th semester
Person responsible for the module	Prof. Rao Vemuri, Assoc. Prof. Phạm Thế Bảo, Dr. Trần Anh Tuấn
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture and labwork
Workload (incl. contact hours, self-study hours)	Total: 165 hours Contact hours: - Lectures: 45 hours, - Labwork: 30 hours Private study: 90 hours (Self-study)
Credit points	4 Credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	Recommended prerequisites: ○ Programming in a modern computer language. ○ First course in computer architecture ○ Access to a personal smart phone or tablet
Module objectives/intended learning outcomes	For this course, the modern world of computing is defined as one based on mobile devices (e.g., smartphones, netbooks, tablets, and similar) as the fundamental computing units that rely on cloud storage (e.g., Google Apps, Flickr/Picasa, Facebook, file backup systems such as Carbonite, and similar). In recent years, new, small, and lightweight, but more intelligent mobile devices and embedded systems, such as smartphones, tablet devices, and other mobile Internet devices, have become popular. These devices present new challenges in programming, security, and data management. This course will introduce the basic concepts and issues in programming mobile devices; mobile device architecture; infrastructures needed to support such devices; power management issues; and information security, data management, and privacy issues. - Specific objectives/course learning outcomes: + Knowledge: get familiar with knowledge of mobile computing + Skills: cognitive and practical abilities to use these knowledges in practical problems.

	+ Attitude: Have the right attitude, perspective, and awareness about the course.
Content	This module includes the following topics: **Section 1:** *What is Mobile Computing? An Overview* **Section 2:** *Wireless Generations: An Overview* **Section 3:** *Mobile Communications & Networks* **Section 4:** *Media access methods: Space, time, frequency, & Code Division.* **Section 5:** *Cellular Concept, System Design issues, satellites.* **Section 6:** *GSM (Global System for Mobile Communications).* **Section 7:** *Portable information appliances: laptops, notebooks, sub- notebooks, and MNCs hand-held computers PDAs and smart phones.* **Section 8:** *Internet: TCP/ IP& de- facto application protocols.* **Section 9:** *Desktop Vs Mobile Device architectures. ARM architecture. What makes mobile environment different?* **Section 10:** *Software architectures for mobile computing.* **Section 11:** *Mobile Operating Systems (Android and iOS)* **Section 12:** *Security in Mobile Systems.* **Section 13:** *Mobile browsers: WebKit.*
Examination forms	Class discussion; mid - term and final - term exam: written exams
Study and examination requirements	Class attendance: 5%. Discussion, exercises, practices: 5%. Midterm exam: 20% Final theory exam: 70%. Final score is greater or equal to 5.0/10.0
Reading list	Main textbook: 1. Jochen Schiller, **Mobile Communications, 2nd edition,** ISBN-13: 007-6092019329.

2.2.9. Specialization in Applied Mathematical Computer Science

1. Object-oriented software development - MTH10308

Module designation	Object-Oriented Software Development
Semester(s) in which the module is taught	5th semester
Person responsible for the module	MSc. Phạm Thi Vương
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture; Lab Works
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Lab Works: 30 hours (in class) + Practice: 30 hours (in class) Private study: 60 hours (self-study)
Credit points	4 Credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	General objectives: To be familiar with object-oriented software development. - Specific objectives/course learning outcomes: + Knowledge: Provide students with in-depth knowledge related to the main subjects in the field of object-oriented software engineering (technology processes, implementation techniques, tools, and deployment environments software,). + Skills: research and work in the field of object-oriented software development. + Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics: 1. Basic concepts of object-oriented software development. 2. Object model, state model, functional model. 3. System design, object design, interface design. 4. Use IDEs and source code management tools.
Examination forms	Project

Study and examination requirements	- Analytical and design skills (30%). - Skills in implementation, implementation, and testing (30%). - Document design skills (20%) - Presentation skills (20%) Final score is greater or equal to 5.0/10.0
Reading list	Main textbook: 1. James Rumbaugh, Michael Blaha, William Premerlani, Frederick Eddy, William Lorensen. Object-Oriented Modeling and Design, Prentice-Hall International Editions, 1991. References: 2. Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides. Design Patterns, Addison-Wesley, 1995. 3. d. Martin Fowler. UML Distilled, 3rd edition, Addison-Wesley, 2004.

2. System and Network Administration - MTH10309

Module designation	System And Network Administration
Semester(s) in which the module is taught	6th semester
Person responsible for the module	MSc. Võ Đức Cẩm Hải
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, labwork
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Lab Works: 30 hours (in class) + Practice: 30 hours (in class) Private study: 60 hours (self-study)
Credit points	4 Credits/ 7 ETCS
Required and recommended prerequisites for joining the module	Computer Networking

Module objectives/intended learning outcomes	General objectives: To be familiar with system and network administration. - Specific objectives/course learning outcomes: + Knowledge: Provides knowledge about network services and principles of network administration in general. + Skills: Equip students with skills in installing and configuring network services on Unix/Linux server environments. After studying, students can take on a part of Unix/Linux server network administration in large companies or manage the entire Unix/Linux network for small and medium-sized businesses. + Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics: - Chapter 1: In this module, students will have more in-depth knowledge of the Unix/Linux operating system environment. Students know how to partition and install a server using Unix/Linux operating systems to get the most out of it. In addition, students will learn about software package installation and management methods. Also, learn how to compile and optimize software features from source code. - Chapter 2: Focuses on user administration principles and practices. Administer system startup and shutdown mechanism. Administration of the file system and administration of some basic services. System log management. Set up an automatic data backup mechanism. - Chapter 3: Focus on configuring network parameters, learn some commands to look up network information, and then learn network security knowledge by firewall. - Chapter 4: Understanding the role of services on the internet. Conduct research and test software such as bind, vsftp, apache, postfix, courier, openssh. - Chapter 5: Learn the role of services on the intranet to set up a Workgroup network, a Domain Controller network to manage and share resources in the intranet. Manage access to internet resources. Conduct research and test software samba, dhcp, and squid. - Chapter 6: Introduction to directory services, configure settings, and prepare sample databases for directory services. Then proceed to integrate the services on the LDAP directory service.
Examination forms	Project; Midterm and final exam: written exams

Study and examination requirements	Diligence: 10% Midterm exam: 10% Project: 50% Final exam: 30% Final score is greater or equal to 5.0/10.0
Reading list	Main textbook: 1. Lars Wirzenius, Joanna Oja, Unix/Linux System Administrator's Guide, CreateSpace Independent Publishing Platform, 2007. 2. Matt Welsh, Unix/Linux Installation and Getting Started, Specialized Systems Consultants, 1995. References: 3. Steve Frampton, Unix/Linux System Administration Made Easy, Linux Documentation Project, 1999. 4. Olaf Kirch, Terry Dawson, Unix/Linux Network Administrator's Guide, O'Reilly, 2000. 5. Matthias Kalle Dalheimer, Matt Welsh, Running Unix/Linux, Fifth Edition, O'Reilly, 2005.

3. Net Programming - MTH10310

Module designation	.NET Programming
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Dr. Trần Anh Tuấn
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, lab works, practicing and discussing in groups
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6.5 ETCS
Required and recommended prerequisites for joining the module	Object Oriented Programming, basic programming skills.
Module objectives/intended learning outcomes	Develop application programming skills with C# on the integrated programming environment Visual Studio .NET.
Content	Using the Visual Studio 2005 environment: design interfaces, perform application tasks, create software components... based on .NET, check for traps, handle errors, and deploy applications. This module includes the following topics: 1. Overview of .NET technology 2. Basic concepts in C# programming language

	3. Windows Form 4. Actions with Files 5. Access databases with .NET 6. Deploy the application
Examination forms	Class discussion; midterm and final exam: written exam
Study and examination requirements	● Class attendance: 5%. ● Discussion, exercises, practices: 5%. ● Midterm exam: 20% ● Final theory exam: 70%. Final score is greater or equal to 5.0/10.0
Reading list	[1] Outline of .Net Programming of Faculty of Information Technology - Hanoi National University of Education. [2] Outline of .Net Programming of Faculty of Information Technology - Ton Duc Thang Semi-Public University. [3] Developing Window Based Applications with Microsoft.Net MCAD_MCSD [4] Course Microsoft 70-316

4. Computer networking - MTH10311

Module designation	Computer Networking
Semester(s) in which the module is taught	6th semester
Person responsible for the module	MSc. Võ Đức Cẩm Hải
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	135 Hours Contact hours: + Lectures: 30 hours (in class) + Practice: 30 hours (in class) Private study: 75 hours (self-study)
Credit points	4 Credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- Basic knowledge of computer networks such as: distinguishing between different types of networks, understanding communication and data transmission bases in networks, and understanding the functions and services that operate at each layer of the OSI and TCP models. /IP. - Students will learn skills in using software tools to capture and analyze data at each floor. Use popular services like web, file transfer, email, domain name, firewall. Configure the router device.

Content	This module includes the following topics: - Chapter 1: Introduction to the overview of computer networks and the applications of computer networks in practice. Classify the types of computer networks and network operating systems. A brief introduction to the OSI and TCP/IP protocol stack. - Chapters 2, 3, 4, 5: Introduce in detail the functions and services of the application, transport, network, and data link layers. The content taught in these chapters follows top-down approaches that will make it easy for students to acquire knowledge about networks. - Chapter 6: Introduction to network security and basics such as encryption methods, authentication methods, understanding some types of network attacks and preventions to ensure network data integrity.
Examination forms	Midterm and final exam: written exams
Study and examination requirements	Diligence: 10% Midterm exam: 10% Practice: 30% Final exam: 50% Final score is greater or equal to 5.0/10.0
Reading list	1. JF Kurose, Computer Networking, A Top-Down Approach Featuring the Internet, 3rd edition, Addison Wesley, 2004. 2. Fred Halsall, Computer Networking, and the Internet, Fifth edition, addison-wesley, 2005 3. Nguyen Thuc Hai, Computer Networks and Open Systems, Education Publishing House, 1997. 4. Andrew S. Tanenbaum, Computer Network, 4th edition, Prentice Hall, 2003.

5. Introduction to Database systems - MTH10312

(see description of this module in Specialization in Data Science)

6. UNIX operating system - MTH10313

Module designation	UNIX Operating System
Semester(s) in which the module is taught	4th and 6th semester
Person responsible for the module	MSc. Vo Duc Cam Hai
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture

Workload (incl. contact hours, self-study hours)	135 Hours Contact hours: + Lectures: 30 hours (in class) + Practice: 30 hours (in class) Private study: 75 hours (self-study)
Credit points	4 Credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Helps students have an overview of computer operating systems in general and in-depth knowledge of Unix/Linux operating systems in particular. Students will be equipped with skills in operating system installation, software package installation/compile, use of utilities and programming (shell, system) on Unix/Linux operating systems. The course will orient students to pursue a career in network system administration or software programming for embedded systems.
Content	● Unix/Linux OS installation process. ● Use Unix/Linux to serve end users. ▪ Unix/Linux external architecture overview. ▪ Basic utility programs in Unix/Linux. ▪ Install/compile software packages in Unix/Linux. ▪ Computer system administration. ● Using Unix/Linux to serve shell programmers: ▪ Do the basics with Shells. Introduction of themes and corresponding usage scripts. ▪ Shell programming. Work with the Shells Script programming language and build application programs. ● Using Unix/Linux to serve system programmers (C programmers): ▪ An overview of how to build and compile C programs in Unix/Linux. ▪ Overview of the internal architecture of the Unix/Linux OS (Unix/Linux Internal). ● Introduce OS components such as file system, Process manager, and write demonstration programs to better understand OS working principle.
Examination forms	Midterm and final exam: written exams
Study and examination requirements	Diligence: 10% Midterm exam: 10% Practice: 30% Final exam: 50% Final score is greater or equal to 5.0/10.0

Reading list	1. Graham Glass, King Ables, Linux for Programmers and Users, Prentice Hall, 2006. 2. Bill McCarty, Learning Red Hat Linux, 3rd Edition, O'Reilly, 2003. 3. Brian Ward, How Linux Works: What Every Super-User Should Know, No Starch Press, 2004. 4. Matthias Kalle Dalheimer, Matt Welsh, Running Linux, 5th Edition, O'Reilly, 2005. 5. Stephen G. Kochan, Patrick Wood, Unix® Shell Programming, Third Edition, Sams Publishing, 2003 6. Cameron Newham, Learning the bash Shell, 3rd Edition, O'Reilly, 2005. 7. Sams Publishing, Sams Teach Yourself Shell Programming in 24 Hour, 1999. 8. Ellie Quigley, UNIX® Shells by Example Fourth Edition, Prentice Hall PTR, 2004 9. Richard Stevens, Sam Advanced Unix Programming, Sams Publishing, 1999. 10. Neil Matthew, Richard Stones, Beginning Linux® Programming, 4th Edition, Wiley Publishing Inc., 2008.

7. Software project management - MTH10314

Module designation	Software Project Management
Semester(s) in which the module is taught	6th semester
Person responsible for the module	MSc. Nguyễn Hiền Lương
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	The document provides students at the first session including: summary lectures, lectures with slides, references. Students attend theoretical lectures and practice, participate in discussion, self-study, and major assignments.
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6.5 ETCS
Required and recommended prerequisites for joining the module	Object-oriented software development

Module objectives/intended learning outcomes	Introduce students to the basics of planning, organizing, and managing software projects.
Content	1. Basic concepts of software project management. 2. GANTT, PERT chart. 3. Software standards, document standards. 4. Risks in the software. 5. Software configuration. 6. Software price estimation model.
Examination forms	Midterm exam: project or written. Final exam: written exam.
Study and examination requirements	Do theoretical and practical exercises in groups (30%). Projects, seminars (70%). Final score is greater or equal to 5.0/10.0
Reading list	[1] P. Jalote. Software Project Management in Practice, Addison Wesley, 2002. [2] I. Somerville. Software Engineering, Addison Wesley, 1996. [3] WA Randolph. Effective Project Planning and Management, Prentice Hall, 1998.

8. Analysis And Design of Information Systems - MTH10315

Module designation	Analysis And Design of Information Systems
Semester(s) in which the module is taught	5th and 7th semester
Person responsible for the module	MSc. Nguyễn Hiền Lương
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, lab works, seminar, project
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6.5 ETCS
Required and recommended prerequisites for joining the module	Introduction to Database systems, Object-oriented programming
Module objectives/intended learning outcomes	Introduce students to classical design and analysis methods used in functional analysis, data analysis, dynamic analysis, and systems design.
Content	Basic system concepts. - Method of surveying the current situation and understanding the needs. - Structured analysis (SA).

	- Linked entity data model, relational data model. - SART method. - SD method.
Examination forms	Final exam: project
Study and examination requirements	- Do theoretical and practical exercises in groups (30%). - Projects, seminars (70%). Final score is greater or equal to 5.0/10.0
Reading list	[1] Nguyen Van Ba. Analysis and design of information systems, National University Publishing House, Hanoi, 2005. [2] Hawryczkiewycz IT. Introduction to System Analysis and Design, Prentice Hall New Delhi, 1989.

9. Java programming - MTH10316

Module designation	Java Programming
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Dr. Nguyễn Tấn Trung
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, labwork
Workload (incl. contact hours, self-study hours)	135 Hours Contact hours: + Lectures: 30 hours (in class) + Lab Works: 30 hours (in class) Private study: 75 hours (self-study)
Credit points	3 Credits/ 5 ETCS
Required and recommended prerequisites for joining the module	Object-Oriented Programming
Module objectives/intended learning outcomes	Students will acquire basic to advanced knowledge and skills in Java programming including: basic programming, object-oriented programming, interface programming. From there, students can learn more about J2EE technology such as programming applications for network and web environments, programming with databases, distributed programming, etc. become a programmer on J2EE technology in the future.
Content	This module includes the following topics: 1. Overview of the Java language 2. Introducing the Java language 3. Objects and classes 4. Error management and garbage collection 5. I/O programming 6. Create user interface

	7. Event modeling with AWT 8. Programming Menus with AWT 9. Multi-threaded programming
Examination forms	Midterm and final exam: written exams
Study and examination requirements	- Attendance: 10% - Midterm exam: 10% - Practice: 30% - Final exam: 50% Final score is greater or equal to 5.0/10.0
Reading list	1. James Gosling - *The Java Language Specification - 2005 (3rd edition)* 2. Ken Arnold, James Gosling - *The Java Programming Language* 3. Trần Tiến Dũng - *Giáo trình lý thuyết và bài tập Java - 1999*

10. Applied Mathematical Computer Science Seminar - MTH10326

Module designation	Applied Mathematical Computer Science Seminar
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Dr. Tran Anh Tuan, MSc. Ha Van Thao, MSc. Nguyen Hien Luong, Dr. Nguyen Minh Man
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Seminar, project
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 60 hours (in class) + Discussion: 20 hours (in class) Private study: 85 hours (self-study)
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	Credited at least 4 compulsory moduls in the Specialization in Applied Mathematical Computer Science
Module objectives/intended learning outcomes	General objectives: Equipping students with basic knowledge to prepare for graduation thesis. - Specific objectives/course learning outcomes: + Knowledge: Master the basic knowledge to prepare for graduation thesis. + Skills: basic skills to prepare for graduation thesis. + Attitude: have the right attitude, perspective, and awareness about the subject.

Content	Students will work directly with faculty on a topic. Topic content can be: 1. Students must clearly understand their math problems. 2. Find related documents. 3. What knowledge is related to this problem? The methods of our predecessors. 4. Synthesize this knowledge into documents. 5. Practice knowledge presentation skills within a certain period.
Examination forms	Class discussion, final exam: project or representation.
Study and examination requirements	Class-attendance: 15% Discussion and practices: 35% Final exam: 50% Final score is greater or equal to 5.0/10.0
Reading list	Depending on assigned topics and supervisors.

11. Computer graphics - MTH10327

Module designation	Computer graphics
Semester(s) in which the module is taught	6th semester
Person responsible for the module	MSc. Hà Văn Thảo
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture and lab work
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: - Lectures: 45 hours, - Labwork: 30 hours Private study: 90 hours (Self-study)
Credit points	4 Credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	Required prerequisite: Introduction to programming, basic informatics. Recommended prerequisite: basic knowledge of programming.
Module objectives/intended learning outcomes	This course provides knowledge of 2D, 3D graphics: algorithms for drawing basic graphic objects, geometric transformations, color models, lighting and shading models... - Specific objectives/course learning outcomes:

	+ Knowledge: get familiar with basic knowledge of computer graphics. + Skills: cognitive and practical abilities to use this knowledge in practical problems. + Attitude: have the right attitude, perspective, and awareness about the course.
Content	This module includes the following topics: 1. Overview of computer graphics 2. Basic graphic objects 3. Transformations in two-dimensional graphics 4. Displays two-dimensional objects 5. Three-dimensional graphics 6. Displays three-dimensional objects
Examination forms	Class discussion; Mid-term and final exam: written exam.
Study and examination requirements	Class attendance: 5% Discussion, exercises, practices: 5% Midterm exam: 20% Final theory exam: 70% Final score is greater or equal to 5.0/10.0
Reading list	1. Hoàng Kiếm, Dương Anh Đức, Lê Đình Duy, Vũ Hải Quân, **Cơ sở đồ họa máy tính**, Education publisher, 2002. 2. Donald Hearn, M. Pauline Baker, **Computer Graphics**, Prentice Hall, 1996. 3. www.wikipedia.org

12. Rendering and Image processing - MTH10331

Module designation	Rendering and Image Processing
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Assoc. Prof. Phạm Thế Bảo, Dr. Trần Anh Tuấn
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture and labwork
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: - Lectures: 45 hours, - Labwork: 30 hours Private study: 90 hours (Self-study)
Credit points	4 Credits/ 6.5 ETCS

Required and recommended prerequisites for joining the module	Required prerequisite: Computer graphics, data structure. Recommended prerequisite: Basic Matlab programming.
Module objectives/intended learning outcomes	This course provides basic knowledge of image processing, combining computer graphics and computer vision. Popular image transformations are used in visual effects or film effects. - Specific objectives/course learning outcomes: + Knowledge: Mastering the basic knowledge of image transformation and processing. + Skills: Analyse and apply algorithms in practice. + Attitude: have the right attitude, perspective and awareness about the course.
Content	This module includes the following topics: 1. Overview of image 2. Common image and video processing methods 3. Image processing operations 4. Camera model
Examination forms	Class discussion; mid-term and final exam: written exam.
Study and examination requirements	Class-attendance: 5% Discussion, exercises, and practices: 5% Midterm exam: 20% Final theory exam: 70% Final score is greater or equal to 5.0/10.0
Reading list	- Main textbooks: 1. Rafael C. Gonzalez and Richard E. Woods, **Digital Image Processing**, 2010. 2. Peter Shirley, Stephen Robert Marschner, **Fundamentals of computer graphics**, 2009. - Reference: 3. Francis S Hill, **Computer graphics**, 1990.

13. Software Testing - MTH10332

Module designation	Software Testing
Semester(s) in which the module is taught	6th semester
Person responsible for the module	MSc. Huynh Thanh Son
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, labwork

Workload (incl. contact hours, self-study hours)	135 Hours Contact hours: + Lectures: 30 hours (in class) + Lab Works: 30 hours (in class) Private study: 75 hours (self-study)
Credit points	3 Credits/ 5 ETCS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	General objectives: To be familiar with software testing and software testing techniques. - Specific objectives/course learning outcomes: + Knowledge: Mastering the knowledge of software testing and software testing techniques, thereby understanding the importance of software testing in the software development process, understanding the role and work of testers. + Skills: research and work in the field of software testing. + Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics: 1. Overview of software testing 2. Basic concepts in software testing 3. Types of software testing 4. Software testing techniques 5. Project management in software testing
Examination forms	Class discussion; Midterm and final exam: written exams
Study and examination requirements	Class-attendance: 5% Practices and exercises: 5% Midterm exam: 20% Final exam: 70% Final score is greater or equal to 5.0/10.0
Reading list	Main textbook: 1. Hung Q. Nguyen, Bob Johnson, Michael Hackett, and Robert Johnson, Kiểm thử các ứng dụng web, NXB ĐHQG TPHCM, 2010. References: 2. Cem Kaner, Jack Falk and Hung Q. Nguyen, Testing Computer Software, 2nd Edition, Wiley, 1999.

14. Web design - MTH10333

Module designation	Web Design
Semester(s) in which the module is taught	7th semester
Person responsible for the module	MSc. Võ Đức Cẩm Hải, Dr. Trần Anh Tuấn
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, labwork
Workload (incl. contact hours, self-study hours)	135 Hours Contact hours: + Lectures: 30 hours (in class) + Lab Works: 30 hours (in class) Private study: 75 hours (self-study)
Credit points	3 Credits/ 5 ETCS
Required and recommended prerequisites for joining the module	Introduction to programming
Module objectives/intended learning outcomes	General objectives: The course provides basic knowledge in the field of website design. Apply graphic design tools for websites. - Specific objectives/course learning outcomes: + Knowledge: Master web application architecture, website design process, website building tools and languages. + Skills: survey, analysis, design, interface building and website deployment. + Attitude: Attend all classroom sessions, and discussions outside of class time; have the right attitude, perspective and awareness about the subject.
Content	This module includes the following topics: 1. Basic HTML 2. Advanced HTML 3. Basic JavaScript 4. Graphic design tools 5. Project
Examination forms	Midterm and final exam: written exams
Study and examination requirements	Midterm exam: 40% Final exam: 60% Final score is greater or equal to 5.0/10.0

Reading list	Main textbook: 1. Nguyễn Quang Hải, Nhập môn HTML và CSS, 2014. 2. Frank Boumphrey, HTML5 for dummies: elearning kit, For Dummies, 2012 References: 3. Open-source web design documents, http://www.w3schools.com

15. Network design - MTH10335

Module designation	Network Design
Semester(s) in which the module is taught	7th semester
Person responsible for the module	MSc. Võ Đức Cẩm Hải, Dr. Trần Anh Tuấn
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, labwork
Workload (incl. contact hours, self-study hours)	135 Hours Contact hours: + Lectures: 30 hours (in class) + Lab Works: 30 hours (in class) Private study: 75 hours (self-study)
Credit points	4 Credits/ 7 ETCS
Required and recommended prerequisites for joining the module	Computer networking
Module objectives/intended learning outcomes	General objectives: The course provides basic knowledge in the field of network design and construction. - Specific objectives/course learning outcomes: + Knowledge: Master the LAN and WAN network design process. + Skills: survey, analyze, design, build, deploy and maintain networks. + Attitude: Attend all classroom sessions, and discussions outside of class time; have the right attitude, perspective and awareness about the subject.
Content	This module includes the following topics: 1. Basic knowledge 2. Overview of network design 3. LAN 4. WAN 5. IP and Routing Protocols 6. Overview of network security
Examination forms	Midterm and final exam: written exams

Study and examination requirements	Midterm exam: 40% Final exam: 60% Final score is greater or equal to 5.0/10.0
Reading list	Main textbook: 1. Diane Teara, Catherine Paquet, Campus network design fundamentals, Cisco Press, 2006. 2. Khương Anh, Giáo trình hệ thống mạng máy tính CCNA 1,2,3,4, NXB Lao động - Xã hội, 2005 References: 3. James F. Kurose, Keith W. Ross, Computer networking: a top-down approach, Pearson, 2008

16. Web Programming PHP - MTH10337

Module designation	Web Programming PHP
Semester(s) in which the module is taught	6th and 8th semester
Person responsible for the module	Dr. Tran Anh Tuan
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, labwork
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Lab Works: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 7 ECTS
Required and recommended prerequisites for joining the module	Introduction to Database Systems; Web Design
Module objectives/intended learning outcomes	General objectives: Provide students with the knowledge to build and develop web applications using PHP technology. - Specific objectives/course learning outcomes: + Knowledge: Mastering the knowledge of building web applications. + Skills: survey, analyze, design, build, deploy and maintain websites. + Attitude: Attend all classroom sessions, and discussions outside of class time; have the right attitude, perspective and awareness about the subject.
Content	This module includes the following topics: 1. Introduction 2. Basic PHP

	3. Advanced PHP 4. PHP and databases 5. PHP and XML 6. Deploying web applications 7. Introduction to PHP frameworks 8. Web security issues
Examination forms	Midterm and final exam: written exams
Study and examination requirements	Midterm exam: 40% Final exam: 60% Final score is greater or equal to 5.0/10.0
Reading list	Main textbook: 1. Phạm Hữu Khang and Phương Lan, Lập trình web bằng php 5.3 và cơ sở dữ liệu MySQL 5.1: tập I, II, NXB Phương Đông, 2010. 2. Luke Welling, Laura Thomson, PHP and MySQL Web development, Addison-Wesley Professional, 2008 References: 3. Refsnes Data, Lectures on open-source PHP, http://www.w3schools.com, 2010

17. Network Security - MTH10339

Module designation	Network Security
Semester(s) in which the module is taught	7th semester
Person responsible for the module	MSc. Hà Văn Thảo
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	135 hours Contact hours: - Lectures: 45 hours (in class) Private study: 90 hours (Self-study)
Credit points	4 Credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	Required prerequisite: Computer network. Recommended prerequisites: Internet and services
Module objectives/intended learning outcomes	This course provides practical knowledge of applications and security standards in computer networks. The course mentions applications that are popularly used in the Internet and collaborative networks; and standards, especially Internet standards. - Specific objectives/course learning outcomes:

	+ Knowledge: get familiar with basic knowledge of network security such as encryption, network security applications. + Skills: cognitive and practical abilities to use these knowledges in practical problems. + Attitude: Have the right attitude, perspective, and awareness about the course.
Content	This module includes the following topics: 1. Overview of computer network 2. Symmetric encryption and message security 3. Public-key cryptography and message authentication 4. Authentication applications 5. Email security 6. IPSec 7. Web security 8. Network security administration
Examination forms	Class discussion; final - term exam: written exam.
Study and examination requirements	Discussion, exercises, practices: 30%. Final theory exam: 70%. Final score is greater or equal to 5.0/10.0
Reading list	1. William Stallings, **Network Security Essentials: Applications and Standards, 2nd Edition**, Prentice Hall. 2. Charlie Kaufman, Radia Perlman, Mike Speciner, **Network Security: Private Communication in a Public World, 2nd Edition**, Prentice Hall.

18. .NET topics - MTH10341

Module designation	.NET Topics
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Dr. Trần Anh Tuấn
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture and lab work
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: - Lectures: 45 hours, - Labwork: 30 hours Private study: 90 hours (Self-study)
Credit points	4 Credits/ 6.5 ETCS

Required and recommended prerequisites for joining the module	Required prerequisite: ASP.NET web programming.
Module objectives/intended learning outcomes	This course provides knowledge of .NET topics. Students can use the knowledge to construct applications for organisations, businesses. - Specific objectives/course learning outcomes: + Knowledge: get familiar with new technology on .NET platform . + Skills: Learn and apply new technology on the .NET platform. + Attitude: have the right attitude, perspective and awareness about the course.
Content	This module includes the following topics: 1. Overview of course 2. New technologies on the .NET platform 3. Programming Windows Phone 4. Introducing frameworks 5. Other problems
Examination forms	Mid-term and final exam: written exam.
Study and examination requirements	Midterm exam: 40% Final theory exam: 60% Final score is greater or equal to 5.0/10.0
Reading list	- Main textbooks: 1. Microsoft, **Tài liệu, mã nguồn các công cụ trên .NET**, 2002: https://msdn.microsoft.com/en-us/dn308572.aspx 2. Robert Powell, Richard Weeks, **C#, and the .NET framework: the C++ perspective**, 2002. - Reference: 3. Chris Maunder, David Cunningham, **Các ứng dụng nguồn mở**, 2010: http://www.codeproject.com

19. Wireless LAN security - MTH10342

Module designation	Wireless LAN Security
Semester(s) in which the module is taught	5th and 7th semester
Person responsible for the module	MSc. Hà Văn Thảo
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture and lab work

Workload (incl. contact hours, self-study hours)	135 hours Contact hours: - Lectures: 30 hours (in class) - Lab work: 30 hours (in class) Private study: 75 hours (Self-study)
Credit points	4 Credits/ 6.5 ETCS
Required and recommended prerequisites for joining the module	Required prerequisite: Computer network
Module objectives/intended learning outcomes	This course provides basic knowledge of wireless network security and types of attack on wireless networks, analysis of characteristics of current wireless LAN security, shows its security vulnerability, and introduces new security standard 802.11i. As a result, wireless LAN security techniques are analysed and improved. - Specific objectives/course learning outcomes: + Knowledge: get familiar with basic knowledge of wireless LAN security. + Skills: cognitive and practical abilities to use these knowledges in practical problems. + Attitude: Have the right attitude, perspective and awareness about the course.
Content	This module includes the following topics: 1. Basic security techniques 2. Types of wireless network attacks 3. IEEE 802.11i 4. Advantages, disadvantages, and improvement of IEEE 802.11i
Examination forms	Class discussion; mid-term and final exam: written exam.
Study and examination requirements	Class-attendance: 5% Discussion, exercises, and practices: 5% Midterm exam: 20% Final theory exam: 70% Final score is greater or equal to 5.0/10.0
Reading list	1. Krishna Sankar, Sri Sundaralingam, Darrin Miller, Andrew Balinsky, **Cisco Wireless LAN Security, Cisco Wireless LAN Security**, Cisco Press, 2004. 2. Jon Edney, William Arbaugh, **Real 802.11 Security, Wi-Fi Protected Access and 802.11i**, Addison Wesley, 2004.

20. SQL Server Database Management system - MTH10344

Module designation	SQL Server Database Management System
Semester(s) in which the module is taught	5st and 7th semester
Person responsible for the module	Dr. Trần Anh Tuấn MSc. Nguyễn Hiền Lương
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, lab works
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Practice: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Introduction to database systems
Module objectives/intended learning outcomes	Students know how to access knowledge about databases and database management systems: components of the SQL Server database management system and their functions, concurrent access management mechanisms, safety and data recovery after incidents, decentralisation and security.
Content	1. Introduction including definition, functions, properties, architecture of database management system, SQL and Microsoft SQL server. 2. Fundamental SQL syntaxes 3. Securing SQL server 4. Stored and manage procedures 5. Creating and managing user-defined functions 6. Creating and managing triggers in SQL server
Examination forms	Midterm and final exam: written exam
Study and examination requirements	Class-attendance: 5% Practices and exercises: 5% Midterm exam: 20% Final exam: 70% Final score is greater or equal to 5.0/10.0
Reading list	Mandatory: Slides and lectures. References: [1] Dương Quang Thiện, SQL Server 2000: Lập trình T - SQL, NXB Văn hóa Sài Gòn, 2007.

	[2] Ray Rankins, Paul Bertucci, Chris Gallelli, Alex T. Silverstein, Microsoft SQL Server 2005 Unleashed, Sams Publishing, 2007. [3] Brian Knightet al, Professional SQL Server 2005 Administration, Wrox Press, 2007. [4] Paul Turley & Dan Wood, Beginning Transact-SQL with SQL Server 2000 and 2005, Wrox Press, 2006.

21. Web programming ASP.NET - MTH10345

Module designation	Web Programming ASP.NET
Semester(s) in which the module is taught	6th and 8th semester
Person responsible for the module	Dr. Trần Anh Tuấn, MSc. Hà Văn Thảo
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, lab work
Workload (incl. contact hours, self-study hours)	165 Hours Contact hours: + Lectures: 45 hours (in class) + Lab Works: 30 hours (in class) Private study: 90 hours (self-study)
Credit points	4 Credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Introduction to Database Systems; Web Design; Object Oriented Programming
Module objectives/intended learning outcomes	General objectives: Providing students with the knowledge to build and develop web applications using ASP.NET technology. - Specific objectives/course learning outcomes: + Knowledge: Master the knowledge of building web applications. + Skills: survey, analyze, design, build, deploy and maintain websites. + Attitude: Attend all classroom sessions, and discussions outside of class time; have the right attitude, perspective and awareness about the subject.
Content	This module includes the following topics: 1. Introduction to the .NET Framework 2. Introduction to ASP.NET 3. ASP.NET Web forms 4. ASP.NET State Management 5. Data Access and Data Binding

	6. Web Services 7. AJAX 8. Introducing some web application development frameworks 9. Deploy and secure web applications
Examination forms	Midterm and final exam: written exams
Study and examination requirements	Midterm exam: 40% Final exam: 60% Final score is greater or equal to 5.0/10.0
Reading list	Main textbook: 1. Nguyễn Ngọc Bình Phương, Các giải pháp lập trình ASP.NET 2.0: tập 1, NXB Giao thông vận tải, 2007. 2. Building ASP.NET application for the web: class notes - ASP0018D, 2010. References: 3. Microsoft's official lectures and source code on asp.net technology, http://www.asp.net, 2010.

2.2.10. Specialization in Theory and Methods of Teaching Mathematics

1. Pedagogy Psychology - MTH10101

Module designation	**Pedagogical psychology**
Semester(s) in which the module is taught	Both 4th and 5th semester
Person responsible for the module	MSc. Trần Hương Thảo,
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	270 Hours Contact hours: Lectures: 90 hour *(in class)* Private study: 180 hours *(self-study)*
Credit points	4 Credits / 7 ECTS
Required and recommended prerequisites for joining the module	*None*
Module objectives/intended learning outcomes	This course equips students with basic psychological knowledge about teachers and learners, problem-solving skills, teamwork skills and apply them to teaching. - Knowledge: Research the psychological problems of managing the teaching-learning process. Determine the conditions to ensure intellectual development in the teaching-learning process. Describe the formation and cultivation of the teacher's personality as well as the psychological development of the learner. - Skills & competences: Developing teamwork skills, presentation skills, report writing, and pedagogical communication skills through various approaches tailored to different age groups of the target audience being taught.
Content	This module includes the following topics: 1. General overview. 2. Fundamental issues in educational psychology 3. Personality psychology of teachers. 4. Pedagogical activities according to the developmental psychology.
Examination forms	Midterm and final exam: written exams.

Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 1. Lê Văn Hồng, Lê Ngọc Lan và Nguyễn Văn Thàng, *Tâm lý học lứa tuổi và tâm lý học sư phạm,* Hà Nội, 1995. 2. Hoàng Anh & Vũ Kim Thanh, *Giao tiếp sư phạm*, Hà Nội, 1995. 3. Trần Thị Hương, Nguyễn Thị Bích Hạnh, Hồ Văn Liên & Ngô Đình Qua, *Giáo dục học đại cương*, Đại Học Sư Phạm TP. Hồ Chí Minh, 2009. 4. Trần Thị Hương, Võ Thị Bích Hạnh, Hồ Văn Liên, Vũ Thị Sai, Võ Thị Hồng Trước, *Giáo dục học phổ thông*, Đại Học Sư Phạm TP. Hồ Chí Minh, 2009. 5. Nguyễn Xuân Thức (chủ biên), *Tâm lý học đại cương*, Đại Học Sư Phạm TP. Hồ Chí Minh, 1995. References: 6. Peter Filene, *The Joy of Teaching: A Practical Guide for New College Instructors*, the University of North Carolina Press, 2005. 7. Ken Bain, What the Best College Teachers Do, Harvard University Press, 2004. 8. Rainer Zwisler, *Einführung in die Pädagogische Psychologie*, 4. Auflage, Weinheim und München, Psychologische Verlags Union Beltz, 1994. 9. J. Zumbach und H. Mandl (Hrsg.), Paedagogische *Psychologie in Theorie und Praxis*, Verlag Hogrefe, 2008. 10. Klafi, W., *Studien zur Bildungstheorie und Didaktik*, Weinheim: Beltz, 1975. 11. Rainer Zwisler, *Einführung in die Pädagogische Psychologie*, Auflage, Weinheim und München, Psychologische Verlags Union Beltz, 1994. 12. Watzlawik, P., Die 5 Kommunikationsaxiome. *In: Kommunikation und Selbstsicherheit, Interaktionsspiel für Schule*, Jugendarbeit und Erwachsenenbildung, Muelheim, 1995.

2. Best practices in teaching - MTH10102

Module designation	Best Practices in Teaching
Semester(s) in which the module is taught	Both 6th and 7th semester
Person responsible for the module	MSc Phan Nguyễn Ái Nhi, MSc Châu Thị Hiếu
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, projec-based learning
Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hour *(in class)* Private study: 120 hours *(self-study)*
Credit points	3 Credits / 5 ECTS
Required and recommended prerequisites for joining the module	*None*
Module objectives/intended learning outcomes	This course plays a crucial role in nurturing foundational knowledge of the fundamental characteristics of contemporary education. It also introduces positive teaching methods (PPGDTC) from the concept, organization, and advantages and disadvantages of each teaching method. From here, learners can approach, select, and flexibly apply these teaching methods in practical classroom settings, teaching in different environments through project activities, in other courses, during teaching internships, and in subsequent teaching activities. - Knowledge: Understanding various teaching methods and current teaching issues. Overview of planning and time management. - Skills & competences: Evaluating the application of methods in real teaching situations. Developing skills in teamwork, presentation, report writing, planning, and time management.
Content	This module includes the following topics: 1. Project-based learning 2. Community Service Learning 3. Positive Teaching Methods
Examination forms	Midterm and final exam: project and written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 1. Robert J. Marzano, Debra J.Pickering, Jane E.Pollock, *Các phương pháp dạy học hiệu quả,* NXB Giáo dục, 2013

	2. *Northern Ireland Curriculum Active Teaching and Learning Methods for Key Stages 1,2 &3,* APMB Publication, 2007 3. Meg. Stephenson, *Service Learning in the Curriculum,* University of Utah, USA, 2003 4. G. Stewart, *Promoting & Managing Effective Collaborative Group Work*, Belfast Education and Library Board, 2014 References: 5. Nhiều tác giả, *Những vấn đề giáo dục hiện nay – Quan điểm và giải pháp*, NXB. Tri Thức, 2008 6. Đặng Thành Hưng, *Tương tác hoạt động Thầy – Trò trên lớp học*, NXB. Giáo dục, 2007 7. Nguyễn Hiến Lê, *Tự học – Một nhu cầu của thời đại, NXB. Văn hóa – Thông tin*, 2007 8. Barbara Gross David, *Tool of Teaching*, Jossey-Bass, 2009 9. James M. Banner. Jr. & Harold C. Cannon, *The Elements of Teaching*, Yale University Press 1997 10. Jeffrey S. Lantis, Lynn M. Kuzma, John Boehrer, *The New International Studies Classroom - Active Teaching, Active Learning,* Lynne Rienner Publishers, United State, 2000 11. Robert S. Feldman, *Power Learning,* McGraw Hill, USA 2003 12. Debra H. Hydorn, *Community Service Learning in Mathematics,* 2011

3. Education Study - MTH10104

Module designation	Education Study
Semester(s) in which the module is taught	Both 5th and 6th semester
Person responsible for the module	MSc Phan Nguyễn Ái Nhi, MSc Châu Thị Hiếu
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, projec-based learning
Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hour *(in class)* Private study: 120 hours *(self-study)*
Credit points	3 Credits / 5 ECTS
Required and recommended prerequisites for joining the module	*None*

Module objectives/intended learning outcomes	This course covers issues in general education, learning outcomes in knowledge, educational objectives regarding attitudes, external orientation attitude groups, internal orientation attitude groups, educational theory, and an overview of educational pathways. - Knowledge: Comparing the educational model in Vietnam with models in other parts of the world. Analyzing the relationship between educational theory and practical issues. - Skills & competences: Selecting teaching methods, assessment methods to design and deliver detailed lesson plans.
Content	This module includes the following topics: 1. Education and the Nature of Education 2. Understanding Human Development 3. Designing Educational Programs 4. Learning Outcomes in Knowledge 5. Educational Objectives in Attitudes 6. Sharing 7. Adaptation 8. Defendse 9. Effort 10. Stability 11. Intelligence 12. Common Issues in Educational Theory 13. Content and Behaviour Rules Evaluation Lesson Design (Basic).
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 1. Nguyễn Thị Bích Hồng và Võ Văn Nam, Giáo dục học đại cương, Giáo trình ĐHSP Tp. HCM, 2004 References: 2. Nguyễn An, Giáo dục học đại cương, Giáo trình ĐHSP Tp. HCM, 1997 3. Hà Thế Ngữ và Đặng Vũ Hoạt, Giáo dục học, tập 1, NXB Giáo Dục, 1988. 4. Đặng Vũ Hoạt (chủ biên), Giáo dục học, tập 2, NXB Giáo Dục, 1995. 5. Phạm Viết Vượng, Giáo dục học, NXB ĐHQG Hà Nội, 2000. 6. Nguyễn Thị Bích Hạnh và Trần Thị Hương, Lý luận dạy học, Giáo Trình ĐHSP TP. HCM, 2004.

	7. Peter Filene, The Joy of Teaching, University of North Carolina Press, 2005. 8. Ken Bain, What the best college teachers do, Harvard University Press, 2004. 9. E. F. Crawley, J. Malmqvist, S. Oslund, D. R. Brodeur, Rethinking Engineering Education: The CDIO Approach, Springer Science+Business Media, 2007.

4. Didactics of teaching - MTH10105

Module designation	Didactics of teaching
Semester(s) in which the module is taught	Both 5th and 6th semester
Person responsible for the module	MSc Bế Phương Thảo
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, projec-based learning
Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hour *(in class)* Private study: 120 hours *(self-study)*
Credit points	3 Credits / 5 ECTS
Required and recommended prerequisites for joining the module	*None*
Module objectives/intended learning outcomes	The theory of teaching presents fundamental concepts in the process of imparting and acquiring knowledge in general, particularly within the school context. Simultaneously, it describes and explains phenomena related to the relationship between teaching and students' learning experiences. - Knowledge: teaching principles, principles of knowledge transmission. - Skills & competences: Handling various teaching situations. Designing teaching scenarios, being proactive, having problem-solving skills, adaptability, and self-regulation.
Content	This module includes the following topics: 1. Fundamental Concepts 2. System of Teaching Principles 3. Principles of Knowledge Transmission
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.

Reading list	Main textbook: 1. Đặng Đức Trọng, Đỗ Thị Bích Trâm, *Lý Luận Dạy học*, NXB Đại học Quốc gia TP. HCM, 2014 References: 2. Bessot, A.,Comiti, C.,Chau,L.T.H.,Tien,L.V. *Những yếu tố cơ bản của Didactic Toán,* NXB Đại học Quốc gia TP. HCM, 2007 3. Marzano, R. J., Marzano, J. S. and Pickering, D. J. *Quản lí hiệu quả lớp học*, NXB Giáo dục Việt Nam, 2011 4. Thái Duy Tuyên, *Phương pháp dạy học, truyền thống và đổi mới*, NXB Giáo dục Việt Nam, 2010 5. Nguyễn Hữu Châu, *Những vấn đề cơ bản về chương trình và quá trình dạy học*, NXB Giáo dục Việt Nam, 2005

5. Elementary Number Theory And Mathematical Logic - MTH10106

Module designation	Elementary Number Theory and Mathematical Logic
Semester(s) in which the module is taught	Both 5th and 6th semester
Person responsible for the module	Dr. Trần Nam Dũng
Language	Vietnamese
Relation to curriculum	Compusary
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hour *(in class)* Private study: 120 hours *(self-study)*
Credit points	3 Credits / 5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	This course provides students with fundamental knowledge in mathematics and mathematical logic helps them to understand and solve mathematical problems in the general education curriculum. It also cultivates their skills in rigorous reasoning for mathematical proofs and enhances their ability to articulate issues succinctly, coherently, and with adherence to standards. - Knowledge: get familiar with basic concepts elementary number theory and mathematical logic. - Skills & competences: cognitive and practical abilities to use these knowledges in solving mathematics problem and teaching mathematichs.

Content	This module includes the following topics: 1. Fundamental Concepts 2. Congruence and Congruence Equations 3. Mathematical Functions 4. Diophantine Equations 5. Propositions and Predicates 6. Mathematical Induction, Contradiction Method
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 1. Nguyễn Hữu Anh, *Toán rời rạc,* NXB GD, 1999. References: 2. G. Polya, *Toán học và những suy luận có lý*, NXB GD,1999 3. Hoàng Chúng, *Số học – Bà chúa của Toán học*, NXB GD, 1997. 4. K.H. Rosen, *Elementary Number Theory And Its Aplications*, Addison – Wesley Publishing Company, 1993.

6. Pedagogical Practice- MTH10112

Module designation	Pedagogical Practice
Semester(s) in which the module is taught	Both 7th and 8th semester
Person responsible for the module	MSc. Đinh Thị Kim Liên
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	360 Hours Contact hours: Lectures: 120 hour *(in class)* Private study: 240 hours *(self-study)*
Credit points	4 Credits / 8 ECTS
Required and recommended prerequisites for joining the module	Pedagogical Psychology, General Education, Didactic of Teaching, Methods of Teaching mathematics I, Methods of Teaching mathematics II.

Module objectives/intended learning outcomes	The course covers the internship process in pedagogy, specifically focusing on the responsibilities of homeroom activities and teaching at secondary schools. It involves organizing teaching and classroom management, activities related to lesson planning, and writing internship reports to create conditions for students to acquire extensive knowledge, skills, and practical experience during the internship. - Knowledge: Organizing teaching and classroom management, activities related to lesson planning, and writing internship reports, practical experience. - Skills & competences: Developing and enhancing teaching skill.
Content	This module includes the following topics: 1. General overview of the pedagogical practice process 2. Homeroom teacher role practice 3. Teaching practice
Examination forms	Midterm and final exam: report final
Study and examination requirements	+ Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 1. Trường Đại học Sư phạm Tp.HCM, *Quy chế thực hành nghiệp vụ sư phạm trong đào tạo giáo viên theo học chế tín chỉ* , 2013 *2.* Bộ Giáo dục và Đào tạo, *Quy chế thực tập sư phạm,* 1986

7. Quality and quality management - MTH10103

Module designation	**Quality and quality management**
Semester(s) in which the module is taught	Both 7th and 8th semester
Person responsible for the module	MSc. Đinh Thị Kim Liên
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hour *(in class)* Private study: 120 hours *(self-study)*
Credit points	3 Credits / 5 ECTS
Required and recommended prerequisites for joining the module	None

Module objectives/intended learning outcomes	The course addresses issues related to quality, quality management, total quality management, continuous improvement through Kaizen, applied to enhancing teaching through lesson research. - Knowledge: Identifying practical education issues and methods to enhance teaching quality. - Skills & competences: Developing and enhancing presentation skills, scientific report writing and analysing data.
Content	This module includes the following topics: 1. Quality and Customers. 2. Total Quality Management (TQM). 3. Culture and cultural scripts. 4. Continuous improvement through Kaizen. 5. Continuous improvement choices.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 3. Japan Human Relations Association, *Guiding continuous improvement through employee suggestions*, 1997. 4. James W. Stigler, J. Hiegert, NXB Trẻ, *Lỗ hổng giảng dạy,* 2012 5. Bộ GDĐT, Dự án Việt – Bỉ *Nghiên cứu khoa học Sư phạm ứng dụng,* 2009. References: 1. Business Edge *Tìm hiểu chất lượng*, 2003. 2. Business Edge *Đạt chất lượng,* 2003 3. Business Edge *Đánh giá chất lượng*, 2003 4. E. F. Crawley, J. Malmqvist, S. Oslund, D. R. Brodeur, *Rethinking Engineering Education: The CDIO Approach,* 2007

8. Elementary Algebra - MTH10121

Module designation	**Elementary algebra**
Semester(s) in which the module is taught	Both 5th and 6th semester
Person responsible for the module	Dr. Tạ Thị Nguyệt Nga
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture

Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hour *(in class)* Private study: 120 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	This course addresses issues related to methods and strategies for solving problems, equations and systems of equations, inequalities and extremum conditions, combinatorial algebra, and methods for solving problems related to sequences and series. - Knowledge: Overview of foundational knowledge in algebra. - Skills & competences: Selecting appropriate theoretical foundations to solve corresponding exercises. Proactively updating and improving new teaching methods.
Content	This module includes the following topics: 1. Methods and strategies for problem solving. 2. Equations and systems of equations 3. Inequalities and extremum 4. Combinatorial algebra 5. Methods for solving problems of sequences and series.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 13. Đoàn Quỳnh, *Đại số 10 nâng cao*, NXB Giáo Dục Việt Nam, 2006. 14. Đoàn Quỳnh, *Đại số và Giải tích 11 nâng cao*, NXB Giáo Dục Việt Nam, 2007. 15. Đoàn Quỳnh, *Giải tích 12 nâng cao*, NXB Giáo Dục Việt Nam, 2008. References: 1. Đoàn Quỳnh, *Tài liệu giáo khoa chuyên Toán - Đại số 10*, NXB Giáo Dục Việt Nam, 2009. 2. Đoàn Quỳnh, *Tài liệu giáo khoa chuyên Toán - Đại số và Giải tích 11*, NXB Giáo Dục Việt Nam, 2010. 3. Đoàn Quỳnh, *Giải tích 12 nâng cao*, NXB Giáo Dục Việt Nam, 2011.

9. Elementary Geometry - MTH10122

Module designation	**Elementary Geometry**
Semester(s) in which the module is taught	Both 5th and 6th semester
Person responsible for the module	Dr. Trần Nam Dũng
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Project, seminar
Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hour *(in class)* Private study: 120 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	*None*
Module objectives/intended learning outcomes	This course equips students with skills in analysis, geometric problem-solving, methods, and problem-solving strategies. - Knowledge: important knowledge to solve geometry problems. - Skills & competences: cognitive and practical abilities to use these knowledges in solving geometry problems.
Content	This module includes the following topics: 1. Methods and Strategies for Problem Solving 2. Solving Problems using Vector Methods 3. Solving Problems using Transformations 4. Coordinate Methods in Plan 5. Coordinate Methods in Space 6. Methods for solving three-dimensional geometry problems
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 1. Đoàn Quỳnh (Tổng chủ biên), *Hình học 10 nâng cao*, NXB Giáo dục 2006. 2. Đoàn Quỳnh (Tổng chủ biên), *Hình học 11 nâng cao*, NXB Giáo dục 2007. 3. Đoàn Quỳnh (Tổng chủ biên), *Hình học 12 nâng cao,* NXB Giáo dục 2008. References: 4. Đoàn Quỳnh (Chủ biên), *Tài liệu giáo khoa chuyên Toán-Hình học 10*, NXB Giáo dục 2009. 5. Đoàn Quỳnh (Chủ biên), *Tài liệu giáo khoa chuyên Toán-Hình học 11*, NXB Giáo dục 2010. 6. Đoàn Quỳnh (Chủ biên), *Tài liệu giáo khoa chuyên Toán-Hình học 12*, NXB Giáo dục 2011.

10. Application of Advanced mathematical methods in solving complex high school's mathematics problem - MTH10123

Module designation	**Application of Advanced mathematical methods in solving complex high school's mathematics problem**
Semester(s) in which the module is taught	Both 7th and 8th semester
Person responsible for the module	Dr. Tạ Thị Nguyệt Nga,
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hour *(in class)* Private study: 120 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	*None*
Module objectives/intended learning outcomes	Equip students with advanced mathematical knowledge through various applications to solve problems in the high school curriculum. This helps students reinforce and enhance their advanced mathematical knowledge, while also teaching them how to solve everyday problems using modern and elegant tools. - Knowledge: advanced mathematical knowledge in solving problem - Skills & competences: solving everyday problems using modern and elegant tools.
Content	This module includes the some in following topics: (change over year) 1. *Applications of Mathematical Analysis* 2. *Applications of Advanced Geometry* 3. *Applications of Graph Theory* 4. *Applications of Group Theory* 5. *Applications of Symmetric Polynomials*
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 1. Nguyễn Viết Đông, Lê Thị Thiên Hương, Nguyễn Anh Tuấn, Lê Anh Vũ, *Toán học cao cấp Tập I,* NXB GD,1999. 2. Nguyễn Viết Đông, Trần Ngọc Hội, *Đại số đại cương*, NXB ĐHQG TP.HCM,2004.

	3. Văn Như Cương, Kiều Huy Luân, *Hình học cao cấp,* NXBGD, 1976. 4. Nguyễn Mộng Hy, *Các bài toán về phương pháp vectơ và phương pháp tọa độ,* NXBGD, 2007. References: 5. Đặng Hùng Thắng, *Một số kiến thức cơ sở về graph hữu hạn*, NXB GD, 2004 6. Hà Huy Khoái, *Chuyên đề bồi dưỡng số học THPT*, NXB GD, 2006 7. J. Rotman, *An introduction to the theory of group*, Springer - Verlag, 1999. 8. K.H. Rosen, *Discrete Mathematics And Its Aplications*, Addison – Wesley Publishing Company, 1993.

11. Classroom Management and Organization - MTH10124

Module designation	**Classroom management and organization**
Semester(s) in which the module is taught	7th and 8th semester
Person responsible for the module	MSc. Phan Nguyễn Ái Nhi, MSc. Châu Thị Hiếu
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, labwork, project
Workload (incl. contact hours, self-study hours)	270 Hours Contact hours: Lectures: 90 hour *(in class)* Private study: 180 hours *(self-study)*
Credit points	4 Credits / 7 ECTS
Required and recommended prerequisites for joining the module	Optimal teaching and learning methods, Pedagogical Psychology
Module objectives/intended learning outcomes	The course provides an overview of issues related to classifying learners, the adaptability between teaching methods and assessment (TM&A) for each learner category. It particularly emphasizes the effective organization and management of the classroom, preparing future teachers with the necessary skills for learners. - Knowledge: Overview of the foundational knowledge of the process of classroom organization and management. Presents the psychophysiological characteristics of each age group of students. Classifies and interacts effectively with each group of students. - Skills & competences: Analyze the effectiveness of teaching methods. Select appropriate assessment methods

	for each specific content and audience. Cultivate the ability to work independently, study, and conduct comprehensive research
Content	This module includes the following topics: 1. Classify learner groups, 2. Adaptability between teaching methods and assessment (TM&A) for each learner group, 3. Organize and manage the classroom
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 9. Phan Nguyễn Ái Nhi, *Tổ chức và quản lý lớp học*, 2014 10. Đặng Thành Hưng, *Tương tác hoạt động Thầy – Trò trên lớp học*, NXB Đại học Quốc gia Hà Nội, 2007 References: 11. Jeffrey S. Lantis, Lynn M. Kuzma, John Boehrer. *The New International Studies Classroom - Active Teaching, Active Learning*, Lynne Rienner Publishers, 2000 12. Klafi, W., *Studien zur Bildungstheorie und Didaktik*, 1975 13. Meyer, H. L., *Trainings programm zur Lernziel analyse,* 1976. 14. Research Council, *How People Learn: Brain, Mind, Experience, and School: Expanded Edition National,* 2000 15. Peter Filene, *The Joy of Teaching: A Practical Guide for New College Instructors*, University of North Carolina Press, 2005

12. Classroom assessment techniques - MTH10125

Module designation	**Classroom assessment techniques**
Semester(s) in which the module is taught	Both 6th and 7th semester
Person responsible for the module	MSc. Phan Nguyễn Ái Nhi, MSc. Châu Thị Hiếu
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, labwork, project
Workload (incl. contact hours, self-study hours)	135 Hours Contact hours: Lectures: 45 hour *(in class)* Private study: 90 hours *(self-study)*
Credit points	3 Credits / 5 ECTS

Required and recommended prerequisites for joining the module	Recommended prerequisites: Calculus 1B or Calculus 1C.
Module objectives/intended learning outcomes	This course oriented towards researching the roles, characteristics, principles, and forms of assessment, as well as the techniques and tools of assessment. It also focuses on establishing standardized evaluation systems to support the future teaching process of learners. - Knowledge: Recognizing the roles of teaching and assessment. Gaining an overview of assessment techniques and tools. - Skills & competences: Constructed appropriate assessment rubrics, compiled exams compatible with course learning outcomes, applied flexible teaching methods to organize classes.
Content	This module includes the following topics: 1. General Overview 2. Assessment Techniques 3. Rubric - an Effective Assessment Tool 4. Organizing Assessment in Teaching.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 16. Thomas A. Angelo & K. Patricia Cross , *Classroom Assessment Techniques: A Handbook for College Teachers,* Jossey-Bass, 1993 17. Linda Suskie, *Assessing Student Learning*, Jossey-Bass, 2009 References: 18. Barbara Gross David, *Tools for Teaching,* Jossey-Bass, 2009 19. Mensa, *Keep Your Brain Fit*, Carlton Books Ltd, 2007 20. National Research Council, *How People Learn: Brain, Mind, Experience and School*, National Academies Press, 2000 21. Robert S. Feldman, *Power Learning*, McGraw-Hill, 2003 22. Steve Frankland, *Enhancing Teaching and Learning through Assessment*, Springer, 2000.

13. Pedagogy Seminar - MTH10126

Module designation	**Pedagogy Seminar**
Semester(s) in which the module is taught	7th or 8th semester
Person responsible for the module	Dr. Trần Nam Dũng MSc. Phan Nguyễn Ái Nhi MSc. Châu Thị Hiếu Dr. Tạ Thị Nguyệt Nga
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Seminar, project
Workload (incl. contact hours, self-study hours)	180 Hours Contact hours: Lectures: 60 hour *(in class)* Private study: 120 hours *(self-study)*
Credit points	4 Credits / 6 ECTS
Required and recommended prerequisites for joining the module	General Education
Module objectives/intended learning outcomes	After completing this course, students will be able to identify issues related to education and mathematics, classify the learning environment, assess influencing factors, and apply appropriate teaching methods and assessment techniques. Additionally, they will analyze core factors in the new educational direction, develop teaching skills in accordance with the designed curriculum, and engage in discussions on specialized topics throughout each week. - Knowledge: List the fundamental factors of the educational curriculum and mathematics. Determine the learning outcomes, teaching methods, and assessment techniques. Classify the learning environment and influencing factors. Provide an overview of new educational perspectives and directions. - Skills & competences: Foster a sense of self-directed learning. Cultivate community service awareness.
Content	This module includes the following topics: 1. Overview of Building a Positive Learning Environment 2. Three Specialized Topics (Students may propose topics for research and reporting on their own) *Teaching: 3 Specialized Topics* Teaching according to Gregorc/Anthony perspectives and the approaches of education innovators worldwide. Teaching with the CDIO approach. STEM/STEAM Education. *Assessment: 2 Specialized Topics*

	The influence of assessment in the teaching-learning process and proposed recommendations. Building a Rubric system for assessing teaching and learning activities. *Mathematics: 3 Specialized Topics* How to help students excel in mathematics? Solutions to support students with disabilities in learning mathematics/developing critical thinking. Building a repository of scenarios/games/model systems, etc., to support the teaching and learning of mathematics.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 1. Cynthia Ulrich Tobias, *Mỗi đứa trẻ một cách học*, NXB. Lao động Xã hội, 2012. 2. Nguyễn Tiến Dũng, *Học và dạy Toán như thế nào*, Sputnik, 2015 3. Edward F. Crawley, Johan Malmqvist, Soeren Oestlund, Doris Brodeur and Christina Edstroem, Rethinking *Engineering Education: the CDIO Approach*, Springer, 2007 4. National Research Council, *Successful K-12 STEM Education*, National The National Research Academies Council Press, Washington, D.C, 2011 References: 5. Anne Bayetto, *Teaching students with learning difficulties in Mathematic*, SPELD SA, 2015 6. James Bellanca, *200+ Active Learning Strategies and Projects*, Corwin Press, 2009 7. Giselle O., Martin-Kniep, *Become A Better Teacher*, ASCD, 2000 8. Ken Bain, *What the Best College Teachers Do,* Harvard University Press, 2004 9. Robert J. Marzano, *Classroom Management that Works,* ASCD, 2003 10. Peter Filene, *The Joy of Teaching: A Practical Guide for New College Instructors*, The University of North Carolina Press, 2005 11. Steve Frankland, *Enhancing Teaching and Learning through Assessment*, Springer Netherlands , 2010 12. Linda Suskie , *Assessing Student Learning*, Jossey-Bass, 2009

	13. Thomas A., Angelo, K., Patricia Cross, *Classroom Assessment Techniques*, Jossey-Bass, 1993

2.2.11. Specialization in Financial Mathematics

1. Elementary Financial Mathematics - MTH10201

Module designation	Elementary Financial Mathematics
Semester(s) in which the module is taught	5th and 7th semester
Person responsible for the module	MSc. Nguyen Huu Toan, MSc. Phan Thi Phuong
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, do exercises, group work
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 exercises hours. Private study: 90 hours *(self-study).*
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Calculus 1A, Calculus 2A
Module objectives/intended learning outcomes	Equip students with the basic knowledge of finance and financial mathematics for discrete non-random models.
Content	Including the theory of interest rates, money chains, forms of borrowing, appraisal of investment projects, valuation of bonds and stocks.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Toán tài chính căn bản, Đinh Ngọc Thanh, Phạm Thị Thu Hồng, Đặng Đức Trọng. 2. Risk and financial management: mathematical and computational methods, Tapiero Charlas

2. Forecasting - MTH10202

Module designation	Forecasting
Semester(s) in which the module is taught	5th and 7th semester
Person responsible for the module	Assco. Prof. Dinh Ngoc Thanh
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	lectures, exercises, practice sessions
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 exercises hours + 30 practical lessons hours. Private study: 60 hours *(self-study).*
Credit points	4 Credits / 7 ECTS
Required and recommended prerequisites for joining the module	Calculus 1A, Calculus 2A, Mathematical Statistics
Module objectives/intended learning outcomes	Provide knowledge and skills to build quantitative models, simulations in economics. Combine with computers to build computational models for forecasting problems.
Content	Forecasting models and methods. Regression models. Time series.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Time series: theory and methods, Davis Richard A , Brockwell Peter J. 2. Phương pháp luận dự báo, Thống kê, 2008, Trịnh Thị Long Hương.

3. Mathematical finance models - MTH10203

Module designation	Mathematical finance models
Semester(s) in which the module is taught	6th and 8th semester
Person responsible for the module	Dr. Nguyen Dang Minh
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, do exercises, group work
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 practical lessons in laboratory. Private study: 90 hours *(self-study).*
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Elementary Financial Mathematics
Module objectives/intended learning outcomes	Knowledge: • Consolidate basic and advanced knowledge of probability theory to apply to solving problems in insurance and finance • Consolidate knowledge about financial markets and financial instruments as the foundation for building financial models to solve practical problems. • Basic introduction to decision making theory. • Building financial risk management models. • Set up several pricing models. Skill: • Applying theory to build models suitable to reality, reflecting the nature of relationships in business-finance. • Using computer software to support calculations in the subject. Study attitude: attend school fully and do homework, ensure self-study time at home.
Content	This course introduces basic financial models to help students understand and apply financial knowledge to solve fundamental financial problems such as decision making, risk assessment, valuation. … in a way that has a clear scientific basis.

Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Phương pháp mô phỏng số Monte Carlo, Nguyễn Quý Hỷ. 2. Phương pháp Monte - Carlo và các vấn đề liên quan Ermakov X. M.

4. Financial and Monetary theory - MTH10204

Module designation	Financial And Monetary Theory
Semester(s) in which the module is taught	6th and 8th semester
Person responsible for the module	MSc. Nguyen Huu Toan, MSc. Phan Thi Phuong
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, do exercises, group work
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 exercises hours. Private study: 90 hours *(self-study).*
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	General Objective: This course explores issues related to interest rates, how financial markets and financial institutions work. This course is divided into 5 parts. Part 1 provides an overview of the financial system, how interest rates are calculated, and how interest rates are structured. Part 2 explores how the debt securities market works. Part 3 learns about the stock market. Part 4 explores the derivatives market. Section 5 explores the activities of commercial banks and non-banks.
Content	Overview of the financial system and financial institutions. Debt stock market. Market share. Derivatives stock market. Commercial banks and non-banking organizations.

Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Chiến tranh tiền tệ, Song Hongbing. 2. Vấn đề đổi mới chính sách Tài chính- Tiền tệ, kiểm soát lạm phát ở Việt Nam và kinh nghiệm của Nhật Bản, Nhà xuất bản chính trị quốc gia.

5. Advanced Financial Mathematics - MTH10209

Module designation	Advanced Financial Mathematics
Semester(s) in which the module is taught	6th and 8th semester
Person responsible for the module	Prof. Dang Duc Trong
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, do exercises, group work
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 practical lessons in laboratory. Private study: 90 hours *(self-study)*.
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Elementary Financial Mathematics
Module objectives/intended learning outcomes	Equip students with advanced knowledge of finance and financial mathematics for discrete stochastic and continuous models.
Content	Covers the basic theory of market derivatives, forwards, options, and swaps.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.

Reading list	1. Toán tài chính nâng cao, Đinh Ngọc Thanh, Phạm Thị Thu Hồng, Đặng Đức Trọng. 2. An introduction to options and futures, The Dryden, 1989, Chance Don M.

6. Quantative Microeconomics - MTH10214

Module designation	Quantative Microeconomics
Semester(s) in which the module is taught	5th and 6th semester
Person responsible for the module	MSc. Dinh Ngoc Tin, MSc. Phan Thi Phuong
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, do exercises, group work
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 exercises hours. Private study: 90 hours *(self-study).*
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Equip students with the basic knowledge of finance, financial market operations and financial mathematics for discrete non-random models.
Content	Including the theory of supply and demand model, inflationary, competitive market, and the state policy.
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	1. Calculus for business, economics, and the social and life sciences, Hoffmann Laurence D., Bradley Gerald L, 2007. 2. Mathematical economics, Dowling Edward T, 2006.

7. Quantative Macroeconomics - MTH10215

Module designation	Quantative Macroeconomics
Semester(s) in which the module is taught	6th and 7th semester
Person responsible for the module	MSc. Dinh Ngoc Tin, MSc. Phan Thi Phuong
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, do exercises, group work
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 exercises hours. Private study: 90 hours *(self-study).*
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Equip students with the basic knowledge of macroeconomics, financial market operations and mathematical quantitative tools in macroeconomics.
Content	Including the theory of commodity and currency markets, expanding supply anh demand model, Phillips curve and the state policy.
Examination forms	Midterm and Final exam: written exams.
Study and examination requirements	Midterm: 30%, Final: 70%
Reading list	1. Money and captal markets: financial institutions and instruments in a global marketplace, Rose Peter S, 1997. 2. Calculus for business, economics, and the social and life sciences, Hoffmann Laurence D., Bradley Gerald L, 2007.

8. Risk management - MTH10216

Module designation	Risk management
Semester(s) in which the module is taught	Both 6th and 7th semester
Person responsible for the module	MSc. Dinh Ngoc Tin
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, exercises
Workload (incl. contact hours, self-study hours)	150 Hours Contact hours: • Lectures and exercises: 75 hour *(in class)* Private study: 75 hours *(self-study)*
Credit points	4 Credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Overview of risk factors in businesses and derivative products. Valuation of derivative products. Risk prevention strategy with derivative products and establishment of financial risk management program. - Knowledge: Understand and identify the types of risks that a business faces. Prioritize treatment of risks. Master the technique of diversifying risks to spread risks and minimize the risks that businesses will face. - Skills & competences: Ability to analyze and evaluate risks. Determine the level of loss caused by the risk and how the risk will affect the goals and benefits of the business. Apply qualitative and quantitative techniques, apply probabilistic and non-probabilistic methods to exploit quantitative data and effectively apply risk management models in decision making. Decisions can be made to address risks. If the risk can be avoided or a plan can be put in place to minimize the risk in the best conditions.
Content	This module includes the following topics: 1. Introducing investors' risks and returns. 2. Banks. 3. Insurance companies and retirement plans. 4. Mutual Funds and Hedge Funds 5. Transactions in financial markets. 6. Risk management of traders. 7. Interest rate risk. 8. Value at Risk

	9. Volatility
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 1. Tapiero Charlas, *Risk and financial management: mathematical and computational methods,* Wiley, 2004. References: 2. London Justin, *Modeling derivatives applications in Matlab, C++, and Excel*, Pearson 2007. 3. Chance Don M, *An introduction to options and futures*, Dryden Press, 1989.

9. Corporate finance - MTH10217

Module designation	Corporate finance
Semester(s) in which the module is taught	Both 6th and 7th semester
Person responsible for the module	MSc. Dinh Ngoc Tin
Language	Vietnamese
Relation to curriculum	Optional
Teaching methods	Lecture, exercises
Workload (incl. contact hours, self-study hours)	150 Hours Contact hours: • Lectures and exercises: 75 hour *(in class)* Private study: 75 hours *(self-study)*
Credit points	4 Credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	None

Module objectives/intended learning outcomes	Capital and capital resources of the enterprise. Cost of capital and capital investment decisions of enterprises. Securities valuation and business valuation. - Knowledge: Understand the three basic issues of corporate finance, including which fields to invest in, how to properly mobilize funding sources, and how the business will have to manage daily financial activities how. Master the concept of working capital, determine the structure of mobilized capital in a way that ensures minimizing mobilization costs, increasing value for the business while still controlling risks for the business. - Skills & competences: Investment planning (Capital Budgeting). Ability to discover investment opportunities that are likely to generate income that exceeds the cost of financing the implementation of that investment. Determine the structure of mobilized capital to ensure minimizing mobilization costs, increasing value for the business while still controlling risks for the business.
Content	This module includes the following topics: 1. Introduction to corporate finance. 2. Discounted cash flow technique. 3. Net present value and investment project appraisal methods. 4. Investment decision. 5. Interest rates and bond pricing. 6. Stock valuation. 7. Risk and return: Lessons from the past. 8. Risk and return: Capital asset pricing model (CAPM)
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 1. Madura Jeff, *International corporate finance,* CENGAGE,2006. References: 1. Bettner Mark, Meigs Robert F., Whittington Ray , Meigs Mary A, *Financial accounting : study guide*, Irwin/McGraw-Hill, 1998. 2. Ferris Kenneth R, *Financial accounting and corporate reporting*, McGraw-Hill Education,1996.

10. Financial Mathematics Seminar - MTH10218

Module designation	Financial Mathematics Seminar
Semester(s) in which the module is taught	7th and 8th semester
Person responsible for the module	Prof. PhD Đặng Đức Trọng, Dr. Nguyễn Đăng Minh, Dr. Trà Quốc Khanh, MSc. Phan Thị Phương, MSc. Nguyễn Hữu Toàn
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Project, seminar
Workload (incl. contact hours, self-study hours)	Total workload: 240 hours Contact hours: 120 hours Private study including examination preparation, specified inhours: 120 hours
Credit points	4 Credits / 8 ECTS
Required and recommended prerequisites for joining the module	Successfully completed 124/134 Credits
Module objectives/intended learning outcomes	After completing the course, students will be able to: • Equip students with advanced knowledge of finance and financial mathematics. • Apply finance and financial mathematics knowledge to analyse the research problem. • Use appropriate techniques for solutions. • Provide a consistent, well-structured report. • Present and defend results of the project at the Students' Seminar Conference.
Content	Various topics
Examination forms	Essay, oral presentation
Study and examination requirements	Minimum attendance at weekly meeting is 80%. Final defense is required. Final score is greater or equal to 5.0/10.0.
Reading list	Diverse documents and depends on the instructor.

11. Financial analysis - MTH10219

Module designation	Financial analysis
Semester(s) in which the module is taught	Both 6th and 7th semester
Person responsible for the module	Dr. Tra Quoc Khanh
Language	Vietnamese
Relation to curriculum	Optional
Teaching methods	Lecture, exercise
Workload (incl. contact hours, self-study hours)	Lecture, exercises
Credit points	150 Hours Contact hours: • Lectures and exercises: 75 hours *(in class)* Private study: 75 hours *(self-study)*
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Financial reports. Analyze financial statements, treasury, financing activities, investment activities, income, and net cash flow. - Knowledge: Provides students with basic knowledge related to the establishment and analysis of financial reports such as balance sheets, business performance reports, and cash flow statements. - Skills & competences: cognitive and practical abilities to use these knowledges in presenting and analyzing data.
Content	This module includes the following topics: 1. Overview of financial statement analysis. 2. Introducing financial reports. 3. Analyze financial ratios. 4. fund analysis and cash flow reports. 5. Analyze sponsorship activities. 6. Analyze investment activities 7. Income analysis 8. Cash flow analysis
Examination forms	Midterm and final exam: written exams.
Study and examination requirements	+ Class-attendance: at least 70%. + Overall grade: minimum 5.0/10.0.
Reading list	Main textbook: 1. W. Steve Albrecht, Earl K. Stice, James D Stice, Ferris Kenneth R., *Financial accounting and corporate reporting,* Cengage Learning, 1996. References:

	2. Bettner Mark, Meigs Robert F. , Whittington Ray , Meigs Mary A, *Financial accounting : study guide*, Irwin/McGraw-Hill, 1998. 3. Madura Jeff, *International corporate finance,* South-Western , Div of Thomson ,2006.

12. Basic Actuarial Mathematics - MTH10220

Module designation	Basic Actuarial Mathematics
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Dr. Tra Quoc Khanh
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 exercises hours. Private study: 90 hours *(self-study)*.
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- General objectives: To gain basic concepts/knowledge on (long-term) actuarial mathematics. - Specific objectives/course learning outcomes: • Knowledge: To explore basic concepts/notation of long-term actuarial mathematics. To explore how the net premium (or pure premium) is calculated for basic life insurance products. • Skills: Calculation skill/ self-study skill. • Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics: 6. Introduction to Life Insurance (or Long-term Insurance) 7. Survival Probabilities 8. Life Table 9. Life Insurance 10. Life Annuities 11. Net Premium Calculation 12. Gross Premium Calculation
Examination forms	Essay Exam
Study and examination requirements	Attendance and Quizzes: 10%, Midterm: 30%, Final: 60%
Reading list	1. D. C. M. Dickson, M. R. Hardy and H. R. Waters, **Actuarial mathematics for life contingent risks,** Cambridge University Press, 2009.

	2. Newton L. Bowers et al, **Actuarial Mathematics**, Society of Actuaries, 1997. 3. Robin Cunningham et al, **Models for Quantifying risk**, ACTEX publication, 2012.

13. Advanced Actuarial Mathematics - MTH10221

Module designation	Advanced Actuarial Mathematics
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Dr. Tra Quoc Khanh
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lectures, group work, small group solving exercises
Workload (incl. contact hours, self-study hours)	165 hours Contact hours: lectures 45 hours + 30 exercises hours. Private study: 90 hours *(self-study)*.
Credit points	4 credits / 6.5 ECTS
Required and recommended prerequisites for joining the module	Basic Actuarial Mathematics
Module objectives/intended learning outcomes	- General objectives: To deep dive on the advanced concepts of (long-term) actuarial mathematics. - Specific objectives/course learning outcomes: • Knowledge: To explore advanced concept of long-term actuarial mathematics: Reserve, Multiple Decrements model, Multiple Lives model, Multiple States model, Universal Life Insurance, Pension Mathematics. • Skills: Calculation skill/ self-study skill. • Attitude: Attend all classroom sessions, and discussions outside of class time.
Content	This module includes the following topics: 1. Reserve 2. Multiple Decrements Model 3. Multiple Lives Model 4. Multiple States Model 5. Universal Life Insurance 6. Pension Mathematics
Examination forms	Essay Exam
Study and examination requirements	Attendance and Quizzes: 10%, Midterm: 30%, Final: 60%
Reading list	1. D. C. M. Dickson, M. R. Hardy and H. R. Waters, **Actuarial mathematics for life contingent risks,** Cambridge University Press, 2009. 2. Newton L. Bowers et al, **Actuarial Mathematics**, Society of Actuaries, 1997.

	3. Robin Cunningham et al, **Models for Quantifying risk**, ACTEX publication, 2012.

3. Non-specialized elective courses

Internship – MTH10549

Module designation	**Internship – MTH10549**
Semester(s) in which the module is taught	7th or 8th semester
Person responsible for the module	Assigned lecturers of the Faculty of Mathematics and Computer Science
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Instructions, hands-on activities
Workload (incl. contact hours, self-study hours)	Total workload: 180 hours Contact hours (lectures, exercises): 90 hours Private study including examination preparation, specified in hours: 90 hours
Credit points	4 (6 ECTS)
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	After completing the course, students will be able to: - Apply knowledeges, skills in mathematics/applied mathematics/computer science to practice with real-life problems in company, industry. - Self-orient in the desired professional field. - Understand the impact of mathematics and computer science in a global, economic, environmental, and societal context. - Conduct work responsibly in cooperation with others. - Write and present a report in an adequate format.
Content	Attendance: Students should attend 100%. Attendance will be regulated and checked. Individual Assignments: Tasks are assigned by the industrial company. Internship: At a company in the field corresponding to the registered major.
Examination forms	Internship report, Oral presentation
Study and examination requirements	Internship certificate issued by the company: 50% Written report and presentation graded by the faculty supervisor: 50%
Reading list	Depending on the assigned tasks and instructors.

4. Graduation knowlege

1. Graduation Project – MTH10597

Module designation	**Graduation Project – MTH10597**
Semester(s) in which the module is taught	8th semester
Person responsible for the module	Assigned lecturers of the Faculty of Mathematics and Computer Science
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Project, seminar
Workload (incl. contact hours, self-study hours)	Total workload: 195 hours Contact hours: 75 hrs Private study including examination preparation, specified in hours: 120 hours
Credit points	6 credits / 12 ECTS
Required and recommended prerequisites for joining the module	Successfully completed 96/131 credits
Module objectives/intended learning outcomes	After completing the course, students will be able to: - Point out the research problems - Apply fundamental knowledge and theories to analyse the research problem; develop a research framework (model if applicable); and design a solution for the problem - Use appropriate techniques for solutions - Demonstrate the scientific contribution and practical relevance of the research carried out - Provide a consistent, well-structured report - Plan and manage learning process - Present and defend results of the project at the Students' Seminar Conference.
Content	Various topics
Examination forms	Presentation, report
Study and examination requirements	Minimum attendance at lectures is 80%. Final defense: 100%.
Reading list	Depending on the instructor

2. Graduation Thesis – MTH10595

Module designation	Graduation Thesis – MTH10595
Semester(s) in which the module is taught	8th semester
Person responsible for the module	Assigned lecturers of the Faculty of Mathematics and Computer Science
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Project, seminar
Workload (incl. contact hours, self-study hours)	Total workload: 300 hours Contact hours: 30 hours Private study including examination preparation, specified in hours: 270 hours
Credit points	10 credits / 20 ECTS
Required and recommended prerequisites for joining the module	Successfully completed 96/131 Credits
Module objectives/intended learning outcomes	After completing the course, students will be able to: - Point out the research problems - Apply fundamental knowledge and theories to analyse the research problem; develop a research framework (model if applicable); and design a solution for the problem - Use appropriate techniques for solutions - Demonstrate the scientific contribution and practical relevance of the research carried out - Provide a consistent, well-structured Bachelor Thesis - Plan and manage learning process - Present and defend results of the thesis at the Students' Bachelor Thesis conference.
Content	Various topics
Examination forms	Graduation report
Study and examination requirements	Final defense: 100%
Reading list	Diverse and depends on the supvervisors