Module description Catalog Program in Mathematics and Computer Science

FACULTY OF MATHEMATICS AND COMPUTER SCIENCE

2024

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# **1.** **General Education**

#### 1. Marxist-Leninist Philosophy - BAA00101

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| --- | --- |
| 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    1. 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.    2. Week 4 (4th session) begins to present in order. Note that the presenting groups need to fully show up and bring along all relevant documents.    3. 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 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 hours (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 the Marxist-Leninist political economy in the context of economic development of the country and the world today. Ensure the basic, systematic, scientific, updating 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 at 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 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:    1. 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.    2. Week 4 (4th session) begins to present in order. Note that the presenting groups need to fully show up and bring along all relevant documents.    3. 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

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| --- | --- |
| Module designation | Scientific Socialism |
| Semester(s) in which the module is taught | 2nd 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 hours (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. * Mid-term exam: essay (opened book). * Final exam: essay (closed book). |
| Study and examination requirements | 1. Regulations for group presentations    1. 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.    2. Week 4 (4th session) begins to present in order. Note that the presenting groups need to fully show up and bring along all relevant documents.    3. 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

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| --- | --- |
| Module designation | History of Vietnamese Communist Party |
| Semester(s) in which the module is taught | 2nd 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 hours (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 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: essay (opened book). * Final exam: essay (closed book). |
| Study and examination requirements | 1. Regulations for group presentations    1. 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.    2. Week 4 (4th session) begins to present in order. Note that the presenting groups need to fully show up and bring along all relevant documents.    3. 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 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. Ho Chi Minh’s Ideology - BAA00003

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| --- | --- |
| Module designation | Ho Chi Minh’s Ideology |
| Semester(s) in which the module is taught | 4th 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 hours (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 defence 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 (opened-book). * Final exam: Essay (opened book). |
| Study and examination requirements | 1. Regulations for group presentations    1. 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.    2. Week 4 (4th session) begins to present in order. Note that the presenting groups need to fully show up and bring along all relevant documents.    3. 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 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 |
| 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 | 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:   1. 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. 2. Specific objectives/course output standards:    1. 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.    2. Skills: Analyzing legal regulations; Lookup legal documents; Working group.    3. 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 textbook, Ho Chi Minh City University of Law. 2. Textbook of Theory of State and Law, Hanoi University of Law. |

#### 7. General Economics - BAA00005

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| --- | --- |
| Module designation | General Economics |
| Semester(s) in which the module is taught | 2nd 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 | 1. Knowledge:    1. 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.    2. Grasp the basic content of Microeconomics - a part of economics. 2. Specifically:    1. Understand the theory of economic choice, the influence of the law of scarcity, and economic models on economic choice.    2. Understand the theory of supply and demand.    3. Understand the theory of consumer behavior.    4. Understand the theory of producer behavior.    5. Understand the theory of competition and monopoly.    6. Understand the theory of factor markets.    7. Understand the theory of the role of government.    8. Understand the analysis of the influence of factors on the balance of the market, in terms of skills.    9. 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.    10. Ability to apply the knowledge learned in the study of macroeconomics, development economics, and several other economic subjects. 3. Skills:    1. 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.    2. Develop reasoning and public speaking skills. 4. Attitude:    1. 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. 5. Other Objectives:    1. Through presentations and problem-solving. Forming and developing collaboration and teamwork skills.    2. Develop skills of creative thinking, discovery, and discovery.    3. Cultivate and develop assessment and self-assessment capacity.    4. 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 module 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 | None |

#### 8. Psychology - BAA00006

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| --- | --- |
| Module designation | Psychology |
| Semester(s) in which the module is taught | 2nd 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:   1. Understand the basic concepts of psychological science and research methods in psychology. 2. Understand the origin, formation and development of psychology and consciousness. 3. Understand the nature of human psychological processes: perception; emotion - affection; act. 4. Identify human psychological states. 5. Understand the psychological attributes that make up the personality structure. Understand the factors affecting the formation and development of personality.   Skills:   1. Developing the capacity to study documents: Analyze, synthesize, compare, and generalize. 2. Formation and developing the ability to identify psychological phenomena and apply learned knowledge to solve practical problems. 3. Consulting and consulting skills.   Attitude:   1. Cultivate a passion for learning and studying subjects. 2. Forming a sense of initiative and positivity in self-study. 3. Formation the right motivation in learning. 4. Raise a sense of responsibility for group activities.   Other goals:   1. Forming personality qualities in accordance with the requirements of the integration period. 2. Forming communication and behavioral skills in the community. 3. Forming a modern and scientific way of living and working. 4. Forming and developing the ability to think creatively, independently, and critically. 5. Reasoning skills, public speaking skills. 6. Form and develop teamwork skills. |
| Content | The course introduces learners to acquire basic knowledge about 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:   1. Plotnik, R, Kouyoumdjian, H (2011). Introduction to Psychology. 2. Berstein, D. A., Penner, L. A., Clarke-Stewart, A., and Roy, E (2008). Psychology. |

#### 9. Group-working and Learning Skills – BAA00008

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| Module designation | Group-working and Learning Skills |
| Semester(s) in which the module is taught | 2nd 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) | 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:   1. Specific objectives/subject output standards: Equip students with knowledge and skills about teamwork and study skills. Bringing career orientations to group work practice topics. 2. Skills: teamwork, presentation, communication 3. 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

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| Module designation | English 1 |
| Semester(s) in which the module is taught | 1st semester |
| Person responsible for the module | Lecturers at Foreign language centre of University of Science, VNU-HCM |
| Language | English |
| Relation to curriculum | Compulsory |
| 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 30 hours; 30 exercise hours  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 | 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:   1. 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. 2. Learners can understand and use grammar structures at the pre-intermediate level such as basic tenses and other related matters. 3. 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. 4. Learners will be able to pronounce single words, word clusters and sentences, describe a given picture, and build basic communications in daily life. 5. Learners will be able to comprehend 300-500 words passage of familiar topics and gain more knowledge of different cultures around the world. 6. 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

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| Module designation | English 2 |
| Semester(s) in which the module is taught | 2nd semester |
| Person responsible for the module | Lecturers at Foreign Language Centre of University of Science, VNU-HCM |
| Language | English |
| Relation to curriculum | Compulsory |
| 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 30 hours; 30 exercise hours  Private study: 60 hours (self-study) |
| Credit points | 3 Credits (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:   1. 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. 2. 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. 3. Learners will be able to choose the correct response for the questions and understand dialogues and short monologues. 4. 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. 5. Learners will be able to comprehend 500 - 700 words passage of familiar topics and gain more knowledge of different cultures around the world. 6. 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

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| Module designation | English 3 |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | Lecturers at Foreign Language Centre of University of Science, VNU-HCM |
| Language | English |
| Relation to curriculum | Compulsory |
| 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 30 hours; 30 exercise hours.  Private study: 60 hours (self-study) |
| Credit points | 3 Credits (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:   1. 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. 2. Learners can understand and use new language in a natural, communicative way. 3. 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. 4. 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 - Ho Chi Minh 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, 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. 3. Materials prepared by the lecturer |

#### 13. English 4 - BAA00014

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| Module designation | English 4 |
| Semester(s) in which the module is taught | 4th semester |
| Person responsible for the module | Lecturers at Foreign Language Centre of University of Science, VNU-HCM |
| Language | English |
| Relation to curriculum | Compulsory |
| 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 30 hours; 30 exercise hours.  Private study: 60 hours (self-study) |
| 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:   1. 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 storytelling. 2. 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. 3. 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 (2012). Collins Skills for the TOEIC test: Speaking and Writing. Harper Collins UK. |

#### 14. Analysis 1A – MTH00010

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| Module designation | Analysis 1A |
| Semester(s) in which the module is taught | 1st semester |
| Person responsible for the module | Dr. Ong Thanh Hai |
| 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: 30 hours (in class); 30 exercise 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 | 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.       2. Calculus, Harcourt Brace College Publishers, New York.       3. Giáo trình Giải tích 1. Nhà xuất bản Thống Kê, Tp Hồ Chí Minh |

#### 15. Calculus 1A – MTH00011

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| Module designation | Calculus 1A |
| Semester(s) in which the module is taught | 1st semester |
| Person responsible for the module | MSc. Nguyen Vu Huy |
| 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: 30 hours (in class); 30 exercise 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 | 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 | Mathematica by example, Academic Press, New York.  Calculus, Harcourt Brace College Publishers, New York.  Giáo trình Giải tích 1. Nhà xuất bản Thống Kê, Tp Hồ Chí Minh |

#### 16. Analysis 2A - MTH00012

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| Module designation | Analysis 2A |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | Dr. Ong Thanh Hai |
| 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: 30 hours (in class); 30 exercise hours  Private study: 90 hours (self-study) |
| Credit points | 3 Credits (5 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:   * + - 1. Knowledge: know the basic concepts of metrics, closed, open, compact sets, completeness, series in normed space.       2. 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, and 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

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| --- | --- |
| 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 |
| 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: 30 hours (in class); 30 exercise hours  Private study: 90 hours (self-study) |
| Credit points | 3 Credits (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:   1. Knowledge: The theory of series of real numbers. Properties of differentiable functions on Rn. 2. 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

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| Module designation | Analysis 3A |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | Assoc. Prof. Ly Kim Ha |
| 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 exercises 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, Calculus 1A, Analysis 2A |
| Module objectives/intended learning outcomes | General objective: Learners understand the integral of functions of many variables and the relationships between the differential and integral of functions of many variables.  Specific objectives:   1. 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. 2. Skills: Introduction to computer tools. Exercises include both reasoning and calculation. 3. 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

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| Module designation | Analysis 4A |
| Semester(s) in which the module is taught | 4th semester |
| Person responsible for the module | Dr. Le Anh Ha |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| 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:   1. Knowledge: Master the course content. 2. Skills: Ability to calculate with large numbers of calculations 3. 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

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| Module designation | Linear Algebra |
| Semester(s) in which the module is taught | 1st semester |
| Person responsible for the module | Dr. Le Van Luyen  Dr. Bui Anh Tuan |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| 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 | General objectives: To be familiar with advanced mathematics.  Specific objectives/course learning outcomes:   1. 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. 2. Skills: Calculating 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. 3. 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. Besides 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. Abstract Algebra – MTH00031

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| Module designation | Abstract Algebra |
| Semester(s) in which the module is taught | 2nd semester |
| Person responsible for the module | Dr. Trinh Thanh Deo |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| 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 | 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. Fundamentals of Computer Programming – MTH00055

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| Module designation | Fundamentals of Computer Programming |
| Semester(s) in which the module is taught | 2nd semester |
| Person responsible for the module | MSc. Nguyen Hien Luong  MSc. Ha Van Thao |
| 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 lab 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 | Introduce to students the logic of computer programming – how computers operate with programming languages ​​and how to write instructions using flowchart or pseudocode; how to modularize a computer program; how to write computer programs in C language. |
| Content | 1. Basic concepts of algorithms and algorithms. 2. Describe the skills and fundamentals of computer programming. 3. Introduction to the C programming language. 4. Pointer. 5. Array and string. 6. Function. 7. Structure. |
| Examination forms | Final exam: written exams. |
| Study and examination requirements | Test 1: 15%  Test 2: 15%  Test 3: 20%  Final exam: 50%  Final score is greater or equal to 5.0/10.0 |
| Reading list | 1. Joyce Farrell, Programming Logic & Design Comprehensive 9th Edition, Cengage Learning, 2018. 2. Wilfried Lemahieu, Seppe Vanden Broucke, Bart Baesens, C The Complete Reference, McGraw-Hill, 2000. 3. Phạm Văn Ất, Kỹ Thuật Lập Trình C Cơ sở và Nâng Cao Tái bản lần thứ 6, Giao Thông Vận Tải Hà Nội, 2006. |

#### 23. Linear Algebra Practice – MTH00083

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| --- | --- |
| Module designation | Linear Algebra Practice |
| Semester(s) in which the module is taught | 1st semester |
| Person responsible for the module | MSc. Pham The Nhan |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| 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 credit (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:   1. 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. 2. Skills: Calculating 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. 3. 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. Besides 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 Software Laboratory – MTH00087

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| Module designation | Computational Software Laboratory |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | Dr. Ong Thanh Hai |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| 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 the 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. Abstract Algebra Practice – MTH00084

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| Module designation | Abstract Algebra Practice |
| Semester(s) in which the module is taught | 2nd semester |
| Person responsible for the module | Dr. Nguyen Kim Ngoc |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | lectures, computer practices |
| Workload (incl. contact hours, self-study hours) | 90 hours  Contact hours: 30 lab hours (in class)  Private study: 60 hours (self-study) |
| Credit points | 1 Credit (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:   1. Knowledge: Master the theory of basic algebraic structures such as groups, rings, fields, and polynomial rings. Get hands-on with software (e.g. GAP) to better understand the structure learned. 2. Skills: Improve reasoning skill and formal calculation. 3. 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 software (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. General Environment – ENV00001

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| Module designation | General Environment |
| Semester(s) in which the module is taught | 2nd semester |
| Person responsible for the module | Lecturers at Faculty of Environment, University of Science, VNU-HCM |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | Lecture |
| Workload (incl. contact hours, self-study hours) | 90 hours  Contact hours: lectures 30 hours (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  General concepts of environment  Basic composition of the environment (volumes)  Chapter 3: Natural Resources  Definition  Classification  General issues of natural disaster  Chapter 4: Human Impact on the environment  History of human impact on the environment  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:   1. Le Van Khoa, Doan Van Canh, Nguyen Quang Hung, Lam Minh Triet (2011). Textbook of People and the Environment, Education Publishing House. 2. Goudie, A. (2006) The Human Impact on Natural. 3. Environment. 6th Edition. Oxford. Blackwell. 4. Le Thi Thanh Mai (2008), Textbook of People and the Environment. National University of Ho Chi Minh City. |

#### 27. Human and Environment - ENV00003

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| Module designation | Human and Environment |
| Semester(s) in which the module is taught | 2nd semester |
| Person responsible for the module | MSc. Le Cong Man (Faculty of Biology and Biotechnology, University of Science, VNU-HCM) |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | Lecture, disscusion |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload: 30  Contact hours (please specify whether lecture, exercise, laboratory session, etc.):  - Lecture hours: 30 hours  - Practical hours: 0  - Exercise hours: 0  - Extra-contact hours per week:  Private study including examination preparation, specified in hours:  hours |
| Credit points | 2 Credits (3 ECTS) |
| Required and recommended prerequisites for joining the module | Required prerequisites: General Biology  Recommended prerequisites: 0 |
| Module objectives/intended learning outcomes | Providing students with knowledge about humans' relationship with nature, including inanimate factors and other living things around humans  Knowledge: knowing the position, tasks, and roles of humans in the ecosystem.  Skills: recognizing results from human activities and impacts on natural and social life.  Attitude, Diligence  Able to practice soft skills (teamwork, presentations) |
| Content | Part 1: The formation of human community and society  Chapter 1: Introduction  Chapter 2: Ecological factors  Chapter 3: Population - biome - ecosystem  Chapter 4: People and the environment  Chapter 5: History of human impact on the environment  Part 2: Needs and products in human society  Chapter 6: Essential human needs  Chapter 7: Resources  Chapter 8: Pollution  Chapter 9: Environmental protection and sustainable development  Chapter 10: Cultural and legal issues.  Part 3: Observe and identify (from an ecological point of view) ongoing phenomena affecting the lives of humans and other living things |
| Examination forms | Mini projects |
| Study and examination requirements | Study Requirements: 0  Examination Requirements:   1. Discuss 2. Teamwork 3. Seminar 4. Learning attitude 5. Final exam |
| Reading list | 1. Phạm Xuân Hậu (1997). Con người và môi trường. NXB Giáo dục. 2. Lê Văn Khoa (chủ biên) (2002). Khoa học môi trường. NXB Giáo dục. 3. Nguyễn Hữu Nhân, Hoàng Quý Tình (2011). Sinh thái học người. NXB Giáo dục. |

#### 28. Earth Science – GEO00002

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| Module designation | Earth Science |
| Semester(s) in which the module is taught | 2nd semester |
| Person responsible for the module | Lecturers at Faculty of Geology, University of Science, VNU-HCM |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| 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 freshwater in hydrosphere, sea and ocean behaviour, 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 | 1. Presentation on deformations of the earth's crust and earthquake, volcanic activities and membrane tectonic mechanism. 2. Learn about Earth's history through fossil and stratigraphic records. 3. Apply this knowledge to explain some issues in the main profession. 4. 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. 1986. 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

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| --- | --- |
| Module designation | General Chemistry 1 |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | Lecturers at Faculty of Chemistry, University of Science, VNU-HCM |
| 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) | 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 | 1. Describe the structure of atoms and molecules. 2. Explain periodic changes in some properties of chemical elements. 3. Identify and distinguish basic types of chemical bonds. 4. 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:  Le Thi So Nhu. Summary of General Chemistry lecture - internal documents (For internal circulation only) |

#### 30. General Chemistry 2 – CHE00002

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| --- | --- |
| Module designation | General Chemistry 2 |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | Lecturers at Faculty of Chemistry, University of Science, VNU-HCM |
| 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) | 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 | Introduce students to the facts, concepts, and vocabulary of chemistry that will enable them to make informed decisions on issues that involve chemical concepts. Give opportunity to use the scientific method to formulate explanations for events in the natural world. Explore the role of measurement in the development of these explanations and the use of logic to test the validity of claims. Show relationships of chemistry to other disciplines, such as mathematics and the biological sciences. Demonstrate the application of chemistry concepts in the everyday world. Give opportunity to apply learned concepts in new situations of both practical and theoretical significance. Give opportunity to read selected scientific materials and apply appropriate language to describe and analyze scientific events. Develop students’ scientific problem-solving skills through sequential, mathematically oriented assignments. |
| Content | The contents are chemical thermodynamics, chemical kinetics, general chemical equilibria, acid and base equilibria, pH, buffers, ionic compound solubility and equilibria electrochemistry. |
| Examination forms | Written exam  Midterm test: 35%  Quiz or Assignment: 15%  Final test: 50% |
| Study and examination requirements | Minimum attendance at lectures is 80% Final score is greater or equal to 5.0/10.0 |
| Reading list | Ralph H. Petrucci, F. G. Herring, J. Madura, C. Bissonnette (2011), General Chemistry, Principles and Modern Applications, Pearson Canada, 10nd Edition. |

#### 31. General Chemistry Laboratory 1 – CHE00081

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| --- | --- |
| Module designation | General Chemistry Laboratory 1 |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | Lecturers at Faculty of Chemistry, University of Science, VNU-HCM |
| 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) | 90 Hours  Contact hours: Exercise: 60 hours  Private study: 30 hours (self-study) |
| Credit points | 2 Credits (4 ECTS) |
| Required and recommended prerequisites for joining the module | General Chemistry 1 |
| Module objectives/intended learning outcomes | 1. Describe the chemical processes of experiments 2. Use the equipment in chemistry lab correctly 3. Calculate, write chemistry laboratory report correctly 4. Work in lab safely, scientifically |
| Content | The objective of the general chemistry laboratory course is to become proficient in techniques used by practicing chemist, to use and handle safely and properly laboratory glassware, to carry out experiments safely and carefully in the laboratory, to obtain data accurately and to manipulate the data correctly. This course also complements and consolidates the theoretical knowledge acquired in the general chemistry lecture course. In as much as this course is only a supplement to general chemistry lecture courses, students must have had the general chemistry lecture. |
| Examination forms | Written exam  Midterm test: 20%  Experimental Reports: 60%  Final test: 20% |
| Study and examination requirements | Minimum lab hours: 7/9  If score of the final exam ≤ 3, the final score will be (midterm test) \*20% + (Average of Experimental Reports) \* 30% + (Final exam) \* 20%. |
| Reading list | Textbooks:   1. General Chemistry Laboratory 1, Hoàng Ngọc Cường (2023). 2. General Chemistry Laboratory 1-Prelab-Report, Hoàng Ngọc Cường (2023). |

#### 32. General Chemistry Laboratory 2 – CHE00082

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| --- | --- |
| Module designation | General Chemistry Laboratory 2 |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | Lecturers at Faculty of Chemistry, University of Science, VNU-HCM |
| 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) | 90 Hours  Contact hours: Exercise: 60 hours  Private study: 30 hours (self-study) |
| Credit points | 2 Credits (4 ECTS) |
| Required and recommended prerequisites for joining the module | General Chemistry 2 |
| Module objectives/intended learning outcomes | 1. Describe the chemical processes of experiments 2. Use the equipment in chemistry lab correctly 3. Calculate, write chemistry laboratory report correctly 4. Work in the lab safely, scientifically |
| Content | General Chemistry Laboratory 2 is an introductory course to the general chemistry laboratory. The overall goal of this course is to introduce general chemistry focused on understanding the concepts within the labs and the scientific method. These concepts include but are not limited to: understanding basic operation in a chemistry laboratory, components of matter, stoichiometry, determination of concentration by titration, weight measuring, preparation and properties of inorganic and organic substances. |
| Examination forms | Written exam Midterm test: 20% + Experimental Reports: 60% + Final test: 20% |
| Study and examination requirements | Minimum lab hours: 7/9  If score of the final exam ≤ 3, the final score will be (midterm test) \*20% + (Average of Experimental Reports) \*30% + (Final exam) \*20%. |
| Reading list | Textbooks:  Hoang Ngoc Cuong, General Chemistry Laboratory 2 Manual |

#### 33. General Biology I - BIO00001

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| --- | --- |
| Module designation | General Biology I |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | Lecturers at Faculty of Biology and Biotechnology, University of Science, VNU-HCM |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | This course introduces the topic, gives questions, asks students to see the clip, discusses and reviews |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload: 135  Contact hours (please specify whether lecture, exercise, laboratory session, etc.):  - Lecture hours: 45  - Practical hours: 0  - Exercise hours: 0  - Extra-contact hours per week: 0  Private study including examination preparation, specified in hours: 90 hours |
| Credit points | 3 Credits (4.5 ECTS) |
| Required and recommended prerequisites for joining the module | None |
| Module objectives/intended learning outcomes | 1. Know the fundamental concepts of biology and the scientific process; distinguish observation, hypothesis, test, and theory 2. Explain the chemical composition of living matter, and chemical reaction related to biology 3. Describe the structure and properties of water, structure and function of large biology molecules 4. Distinguish the structure and function of cells, membranes and cellular organelles 5. Describe metabolism at the cellular level, including enzyme activity, cellular respiration, and photosynthesis. 6. Describe DNA structure and function, including replication and repair, transcription, and translation. 7. Describe the mechanism of genetic: cell division, fertilization, mutation, and genetic variation. 8. Explain Biotechnology 9. Explain the evolution and biodiversity 10. Describe the concepts and mechanisms of the origin of species |
| Content | Introduction to Biology:  The fundamental concepts in biology  The scientific methods to study life  Part 1. The chemical of life  Part 2. The Cell  Part 3. Genetics  Part 4. Mechanisms of Evolution  Conclusion |
| Examination forms | Multiple choice test |
| Study and examination requirements | Students create groups: listen, write, and give questions and answers.  6 Quizzes - Midterm examination - Final examination |
| Reading list | Textbooks   1. Bui Trang Viet (2012). Cell Biology. VNU-HCM. 2. Pham Thanh Ho (2011). Biology: Cell, genetics and evolution. VNU-HCM.   Supplementary reading   1. Reece J. B., Urry, L. A., Cain M. L. 1., Wasserman S. A., Minorsky P. V., Jackson R.B., & Campbell N. A. (2014). Campbell biology (1st edition), Pearson. 2. Lecture slides and related clips. |

#### 34. General Biology II - BIO00002

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| --- | --- |
| Module designation | General Biology II |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | Lecturers at Faculty of Biology and Biotechnology, University of Science, VNU-HCM |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | Lecturing, posing questions for discussions, presenting videos, giving homework |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload: 135  Contact hours (please specify whether lecture, exercise, laboratory session, etc.):  - Lecture hours: 45  - Practical hours: 0  - Exercise hours: 0  - Extra-contact hours per week: 0  Private study including examination preparation, specified in hours: 90 hours |
| Credit points | 3 Credits (4.5 ECTS) |
| Required and recommended prerequisites for joining the module | Required prerequisites:  Recommended prerequisites: General Biology I |
| Module objectives/intended learning outcomes | PART 1. PLANT MORPHOLOGY AND FUNCTION  Learners get to know about plant morphology, functions, and their ecological relationships. They explore nutrient absorption, material transport in vascular plants, and the vital role of soils in providing nutrients. Additionally, they examine plant life cycles, reproductive systems, and how plants respond to environmental cues for survival.  PART 2. ANIMAL MORPHOLOGY AND FUNCTION  Learners explore the correlation between animal anatomy and physiology. They delve into the structure and functions of key systems including digestion, circulation, respiration, immunity, endocrinology, reproduction, and the nervous system. Additionally, they study osmoregulation, excretion processes, and the mechanisms underlying animal sensation and movement.  PART 3. ECOLOGY  Learners explore ecological factors and their impacts on organisms, studying adaptation strategies. They learn about ecosystem components, structural dynamics, functional processes, material and energy cycling, and equilibrium within ecosystems. Concepts of population dynamics, community interactions, and biosphere principles are also covered, along with the significance of biodiversity conservation for sustaining ecosystems locally in Vietnam and globally. |
| Content | Part 1. Plant Morphology and Function  Part 2. Animal Form and Function  Part 3. Ecology |
| Examination forms | Multiple choice test |
| Study and examination requirements | None |
| Reading list | Textbooks in English   1. Begon M., J.L. Harper, and C.R. Townsend (1986). Ecology: Individuals, Populations and Communities, Blackwell Scientific Publications. 2. Brooker, R.J, Widmaier E.P; Graham L.E and Stiling P.D. (214). Biology, McGraw-Hill. 3. Campbell N.A, J.B. Reece, L.A. Urry, M.I. Cain, S.A. Wasserman, P.V. Minorsky, and R. B. Jackson (214). Biology (1st Edition), Pearson, Benjamin Cummings. 4. Stiling P. D. (22). Ecology: Theories and Applications (Fourth Edition), Prentice-Hall, Inc. 5. Smith A.M; Coupland G; Dolan L; Harberd N; Jones J; Martin C; Sablowski R; and Amey A. (21). Plant biology, Garland Science.   Textbooks in Vietnamese   1. Nguyễn Đình Giậu (1997). Sinh học Đại cương, Tủ sách ĐH. KHTN. 2. Dương Hữu Thời (1998). Cơ sở Sinh Thái Học, Nhà xuất bản Đại học Quốc Gia Hà Nội. 3. Hoàng Kim Ngũ, Phùng Ngọc Lan (1998). Sinh Thái Rừng, Nhà xuất bản Nông Nghiệp. 4. Lê Văn Khoa, Nguyễn Văn Cự, Lê Đức, Lưu Đức Hải, Thân Đức Hiền, Trần Khắc Hiệp, Nguyễn Đình Hòe, Phạm Ngọc Hồ, Trịnh Thị Thanh (21). Khoa Học Môi Trường, Nhà xuất bản Giáo dục Việt Nam. 5. Trần Kiên, Hoàng Đức Nhuận, Mai Sỹ Tuấn (22). Sinh Thái Học và Môi trường, Nhà xuất bản Giáo Dục.   Other sources:  Website E-learning KhanViet - ĐH Khoa học Tự Nhiên Thành phố Hồ Chí Minh. |

#### 35. Labwork on General Biology I - BIO00081

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| Module designation | Labwork on General Biology I |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | Dr. Luong Thi My Ngan (Faculty of Biology and Biotechnology, University of Science, VNU-HCM) |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | Lecture   1. Introduction to laboratory rules 2. Divide students into groups of three or two 3. Guide experimental procedure   Monitor and examine students doing experiments |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload: 30  Contact hours (please specify whether lecture, exercise, laboratory session, etc.):  - Lecture hours: 0  - Practical hours: 30  - Exercise hours: 0  - Extra-contact hours per week:  Private study including examination preparation, specified in hours: |
| Credit points | 1 Credits (2 ECTS) |
| Required and recommended prerequisites for joining the module | Required prerequisites: General Biology 1 |
| Module objectives/intended learning outcomes | Prepare temporary slides to observe cell structures and living activities.  Use a microscope proficiently.  Identify organic compounds (carbohydrates, proteins, lipids, enzymes like amylase).  Demonstrate and measure plant respiration.  Classify plants (lichens, algae, bryophytes, pteridophytes, gymnosperms, monocots, dicots).  Classify animals into major orders.  Use basic lab tools (test tubes, beakers, pipettes, etc.) effectively.  Collaborate and assist team members to complete tasks on time.  Follow lab safety rules and ensure personal and team safety. |
| Content | Introduction of Syllabus  How to use a light microscope  Cell structure; Osmosis; Chemical Composition of Cells; Enzyme Activity; Respiration; Mitosis; Microbial Diversity. Plant Diversity; Animal Diversity |
| Examination forms | Lab Activity and Lab Report  Lab exam |
| Study and examination requirements | Study Requirements:   1. Listen 2. Do experiments 3. Making lab report 4. Put tools back in right places 5. Clean up.   Examination Requirements: Experimental process & Final exam |
| Reading list | Compulsory:   1. Lab manual: Bui Trang Viet & Le Thi My Phuoc (Editors) (2016), Lab work on General Biology I (Internal circulation) 2. Class lecture (ppt file) for Lab work on General Biology I   Supplementary:  Dickey Jean (2003) Laboratory investigations for biology |

#### 36. Labwork on General Biology II - BIO00082

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| Module designation | Labwork on General Biology II |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | MSc. Phan Ngo Hoang (Faculty of Biology and Biotechnology, University of Science, VNU-HCM) |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | preaching, guiding, discussion |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload: 30  Contact hours (please specify whether lecture, exercise, laboratory session, etc.):  - Lecture hours: 0  - Practical hours: 30  - Exercise hours: 0  - Extra-contact hours per week:  Private study including examination preparation, specified in hours: |
| Credit points | 1 Credits (2 ECTS) |
| Required and recommended prerequisites for joining the module | Required prerequisites: General Biology 2 |
| Module objectives/intended learning outcomes | 1. Distinguish different plant tissues and organs. 2. Understand and classify plant pigments. 3. Demonstrate environmental impacts on photosynthesis. 4. Explore respiration and fermentation in plants. 5. Identify different animal tissues and prove bioelectricity. 6. Explain hormonal effects on blood flow. 7. Understand climatic impacts on ecosystems. 8. Describe biological reactions and processes. 9. Interpret respiration and photosynthesis. 10. Explain cellular signal transduction. 11. Distinguish plant and animal structures and evolution. 12. Conduct and analyze biological experiments and biodiversity research. |
| Content | 1. Practice theory 2. Tissue and plant organs 3. Plant pigments 4. Photosynthesis 5. Respiration and fermentation in plants 6. Water transport of tissues 7. Animal tissues 8. Mechanical and bioelectric activities 9. Circulation of blood in the vein 10. Climate factor |
| Examination forms | Abstract paper: objectives, principles and methods of practice  Practice report  Practice and question |
| Study and examination requirements | 1. Listen, take note, practising, discussing 2. Students must not be absent in practice theory class (the first week) 3. Students wear blouses when entering the Lab 4. Submit practice reports at the end of the practice session 5. Students who are absent for more than 2 practice sessions will be banned from the final exam.   Examination Requirements:   * 1. Homework   2. Lab work   3. Final examination |
| Reading list | Textbooks:  Bùi Trang Việt và Phan Ngô Hoang 2009. Giáo trình thực tập Sinh học đại cương II. Trường ĐH KHTN - ĐHQG-HCM  Supplementary reading:   1. Lecture notes 2. Phạm Thành Hổ 1998. Sinh học đại cương. Nhà xuất bản giáo dục. |

#### 37. General Physics 1 (Mechanics and Thermodynamics) – PHY00001

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| Module designation | General Physics 1 (Mechanics and Thermodynamics) |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | Prof. Chau Van Tao (Faculty of Physics and Engineering Physics, University of Science, VNU-HCM) |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | Lecture, discussion. |
| 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 achieve the following:   1. 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. 2. Skills: Be able to work at an individual level and group work. 3. Competence: Ability to apply mechanics and thermodynamics knowledge to analyze physical situations. 4. Attitude: Honest |
| Content | This module includes the following topics:   1. Physics and measurement 2. Kinematics of particles 3. Force and Newton's laws 4. Conservation laws in classical mechanics 5. Kinetics of rigid bodies 6. The ideal gas 7. The first law of thermodynamics 8. The second 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:  Nguyen Nhat Khanh (2005). Mechanics and thermodynamics lectures. VNUHCM Publishing House, Vietnam.  References:   1. Nguyen Thanh Van. (2013) General Physics 1. VNUHCM Publishing House, Vietnam. 2. Raymond A. Serway, John W. Jewett, Sr, (2014). Physics for Scientists and Engineers with Modern Physics. Brooks/Cole Publishing Company, USA. 3. Alan Giambattista, Betty McCarthy Richardson, Robert C. Richardson, (2010). Physics. McGrawHill Companies, Inc, USA. |

#### 38. General physics 2 (Electromagnetism - Optics) – PHY00002

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| Module designation | General Physics 2 (Electromagnetism - Optics) |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | Assoc. Prof. Huynh Truc Phuong (Faculty of Physics and Engineering Physics, University of Science, VNU-HCM) |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | Lecture, lesson, discussion |
| 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 | Calculus 1A, 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 achieve the following:   1. Knowledge: Be able to understand and apply knowledge of electromagnetism and optics in science and life. 2. Skills: Be able to work at individual level and teamwork. 3. Competence: Ability to apply electromagnetism and optics knowledge to analyze physical situations. 4. 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:  Nguyen Thanh Van. (2015) General Physics. 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. |

#### 39. Labwork on General Physics – PHY00081

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| Module designation | Labwork on General Physics |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | MSc. Huynh Thanh Nhan (Faculty of Physics and Engineering Physics, University of Science, VNU-HCM) |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | Lab work, discussion, practice |
| Workload (incl. contact hours, self-study hours) | 120 Hours  Contact hours: Lab work: 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 achieve the following:   1. 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. 2. Skills: Be able to work in individual, group work, self-study, and problem solving. 3. Competence: Be able to analyze, process and write experimental data reports. 4. 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 temperatures. 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 dependent of different temperatures. 7. Practice 7: Voltmeter and Ammeter DC. Voltmeter and Ammeter AC. 8. Practice 8: AC circuit. RLC circuit. 9. Practice 9: Diode characteristics. 10. Practice 10: Transistor characteristics. 11. Practice 11: Microscope. To measure the diameter of other small objects. 12. Practice 12: Refraction by a prism. Dispersion and resolving the power of 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 | Dang Van Liet, Do Dinh Luyen, Nguyen Van Nghia, Tran Thi Kim Phuong, “General Physics Experiments”, University of Science, VNU-HCM, 2008. |

#### 40. Introduction to Informatics – CSC00003

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| --- | --- |
| Module designation | Introduction to Informatics |
| Semester(s) in which the module is taught | 1st semester |
| Person responsible for the module | Lecturers at Centre of Informatics, University of Science, VNU-HCM |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lecture, problem, lab works |
| Workload (incl. contact hours, selfstudy hours) | Total workload: 165 hrs  Contact hours: Lectures: 15 hours (in class) and lab works 6 it 0 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:   1. Explain common concepts and terms related to the field of computer science. 2. Perform basic operations related to the Windows operating system and common software. 3. Create documents with professional format, structure, and presentation using software. 4. Analyze and organize data in spreadsheet format, use calculation, search, and statistical functions to create formulas for data processing and presentation. 5. Create eye-catching presentations. 6. Express concepts related to the Internet, information security on the network. 7. Be aware of searching for information and legal regulations regarding copying, sharing, and posting information on the Internet. 8. Design a basic electronic information page. |
| Content | 1. Basic understanding of IT    1. Basic knowledge of computers and computer networks.    2. Access control, ensuring data security, Malware.    3. Basic legal issues in using IT. 2. Basic computer usage    1. Windows operating system    2. Windows Explorer    3. Control Panel    4. Data compression and extraction    5. Typing in Vietnamese 3. Basic Microsoft Word    1. Document composition    2. Text formatting    3. Creating tables    4. Handling graphics in documents    5. Page layout and printing 4. Basic Microsoft PowerPoint    1. Basic presentation templates    2. Creating a presentation    3. Setting up effects for the presentation 5. Basic Microsoft Excel    1. Data formatting in Excel    2. References in Excel    3. Basic Excel functions    4. Printing and creating charts 6. Internet usage    1. Basic knowledge of the Internet    2. Information searching    3. Information security 7. Web image processing    1. Resizing image frames    2. Image cropping    3. Image rotation and flipping    4. Adjusting the brightness of an image    5. 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 | 1. Curriculum for Basic IT Applications, Advanced IT Applications. 2. Microsoft Office MOS materials, IIG Vietnam, Fahasha. 3. IC3 Spark materials, IIG Vietnam, Fahasha. |

# **2. Professional Education Knowledge**

## 2.1. Basic knowledge

#### 1. Mathematical Statistics - MTH10404

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| Module designation | Mathematical Statistics |
| Semester(s) in which the module is taught | 4th semester |
| Person responsible for the module | Dr. Hoang Van Ha |
| 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 the 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 (MTH10401), Analysis A1 (MTH00010) |
| Module objectives/intended learning outcomes | This course provides foundations of statistical inference. Students will be able to make inferences from data, make decisions and predictions. 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. |

#### 2. Data Structures and Algorithms - MTH10405

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| --- | --- |
| Module designation | Data Structures and Algorithms |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | MSc. Ha Van Thao |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Learning materials are provided for students at first lessons including: slide lectures, seminar topics, theory, and practice exercises.  Students have to self-study, do 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 the laboratory.  Private study: 90 hours *(self-study).* |
| Credit points | 4 credits (6.5 ECTS) |
| Required and recommended prerequisites for joining the module | Fundamentals of Computer Programming (MTH00055) |
| Module objectives/intended learning outcomes | Present several basic knowledge 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:   1. Knowledge: Clearly understanding algorithms, search methods, arrangements, and dynamic data structures 2. Skills: analyzing algorithms, generalize data, algorithm settings 3. 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. |

#### 3. Discrete Mathematics - MTH10406

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| --- | --- |
| Module designation | Discrete Mathematics |
| Semester(s) in which the module is taught | 4th semester |
| Person responsible for the module | Dr. Le Van Hop |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| 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 | Fundamentals of Computer Programming (MTH00055) |
| Module objectives/intended learning outcomes | General objectives: providing basic knowledge for information technology students.  Specific objectives / course learning outcome:   1. Knowledge: Mastering logical issues, set- mapping, relations on sets. 2. 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. 3. 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 helps students a lot 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. |

#### 4. Object Oriented Programming - MTH10407

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| Module designation | Object Oriented Programming |
| Semester(s) in which the module is taught | 5th semester |
| Person responsible for the module | MSc. Nguyen Ngoc Long |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | lecture, lab work |
| 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 ETCS) |
| Required and recommended prerequisites for joining the module | Data Structures and Algorithms (MTH10405), Fundamentals of Computer Programming (MTH00055) |
| 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 | 1. The principles of object-oriented methodology. 2. The principles for building object classes, data identification and manipulation, establishing relations between classes, especially inheritance relation and polymorphism. 3. 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.  1. J Rumbaugh, M Blaha, W Premerlani, F Eddy, W Lorensen, Object-Oriented Modeling and Design, Prentice Hall, 1991. |

#### 5. Measure Theory and Probability - MTH10401

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| --- | --- |
| Module designation | Measure Theory and Probability |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | Prof. Dang Duc Trong |
| 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 |
| 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 the theory of integral, and the 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 |

#### 6. Algebra A2 - MTH10402

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| Module designation | Algebra A2 |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | Dr. Tran Ngoc Hoi |
| 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 for course learning outcomes:   1. Knowledge: Master the diagonalization and Jordanization of linear operators on finite-dimensional vector spaces, the structure of Euclidean spaces, bilinear forms, and quadratic forms. 2. Skills: Diagonalization and Jordanization of matrices on numeric fields, computation in Euclidean space, quadratic transformations. 3. 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 | Midterm and Final exam: written 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. |

#### 7. Functional Analysis - MTH10403

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| --- | --- |
| Module designation | Functional Analysis |
| Semester(s) in which the module is taught | 5th semester |
| Person responsible for the module | Assoc. Prof. Bui Le Trong 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 (MTH00010), Analysis 2A (MTH00012), Analysis 3A (MTH00014) |
| 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:   1. 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.   2. 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.   3. 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 |

## 2.2. Required Courses for Specialization

### 2.2.1. Specialization in Data Science

#### Introduction to Database systems - MTH10312

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| Module designation | Introduction To Database Systems |
| Semester(s) in which the module is taught | 4th semester |
| Person responsible for the module | MSc. Nguyen Hien Luong |
| 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 | None |
| Module objectives/intended learning outcomes | Introduce students to basic concepts of databases; data models; database design; standard forms and normalization; NoSQL database. |
| Content | 1. Basic concepts of databases. 2. Entity-Relationship data model, relational data model. 3. Operations on the relational data model. 4. SQL language query. 5. Relational database design. 6. Standard forms and normalization algorithms for databases. 7. NoSQL database. |
| Examination forms | Final exam: written exam. |
| Study and examination requirements | Test 1: 15%,  Test 2: 15%,  Test 3: 20%,  Final exam: 50%  Final score is greater or equal to 5.0/10.0 |
| Reading list | 1. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems 7th edition, Pearson, 2016. 2. Wilfried Lemahieu, Seppe Vanden Broucke, Bart Baesens, Principles of Database Management, Cambridge University Press, 2018. 3. Michael Kaufmann, Andreas Meier, SQL and NoSQL Databases, Springer, 2023. |

#### Introduction to Artificial Intelligence - MTH10318

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| --- | --- |
| Module designation | Introduction to Artificial Intelligence |
| Semester(s) in which the module is taught | 5th semester |
| Person responsible for the module | Assoc. Prof. Nguyen Thanh Binh |
| 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 (MTH10405)  Discrete Mathematics (MTH00041)  Recommendation: 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, and genetic algorithms. |
| Content | 1. Overview of the science of AI 2. State space and the search problem 3. Knowledge demonstration 4. Introduction to machine learning and knowledge discovery 5. Introducing Ontology and Intelligent Agent 6. Introduction to Genetic Algorithms (GA) 7. Introducing Fuzzy Logic 8. 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 |

#### Introduction to Machine Learning - MTH10353

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| --- | --- |
| Module designation | Introduction to Machine Learning |
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Dr. Huynh The Dang |
| 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 | Measure Theory and Probability (MTH10401)  Mathematical Statistics (MTH10404)  Linear Algebra (MTH00030) |
| 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, ... This is necessary knowledge to serve the scientific research work of students in the future. |
| Content | * 1. Closed and open Leontief model, direct and indirect costs   2. Labor theory of value, substitution theorem   3. Linear optimal model, producible set, efficient production, production constraints, consumption   4. Nonlinear optimization model, modern theory of demand, extended theory of production   5. Equilibrium in the market economy, budget constraints, Walras-Wald model, Arrow-Debreu-Mckenzie model   6. 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. |

#### Analysis of Statistical Data - MTH10513

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| --- | --- |
| Module designation | Analysis of Statistical Data |
| Semester(s) in which the module is taught | 5th semester |
| Person responsible for the module | Dr. To Duc Khanh |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | Lectures, group work |
| Workload (incl. contact hours, self-study hours) | 120 Hours  Contact hours:  Lectures: 30 hours *(in class)* + 30 hours computer lab  Private study: 60 hours *(self-study)* |
| Credit points | 3 Credits (5 ETCS) |
| Required and recommended prerequisites for joining the module | None |
| Module objectives/intended learning outcomes | The course provides students with a comprehensive perspective on data processing in general and statistical data analysis in particular. It equips students with the necessary skills to become data scientists, enabling them to independently complete an entire data processing cycle using statistical analysis methods with R program.  Knowledge: Gain a solid understanding of the steps involved in a statistical data processing cycle. Distinguish between different types of data and select appropriate approaches.  Skills & competencies: Through laboratory activities, the course provides the necessary tools for data processing, using the R statistical software. Through the laboratory activities and group work, the student will be able to:   1. recognize and appropriately describe the case study. 2. effectively apply various analytical methods to different types of data and organizational/business questions. 3. increase sensitivity and criticality in the use of statistical methods regarding case studies. 4. work in a group. 5. develop analytical skills and independent judgment. 6. develop communication skills. |
| Content | This module includes the following topics:   * + - 1. Introduction to statistical data processing.       2. Data and some statistical concepts.       3. A/B testing.       4. Linear regressions and Prediction.       5. Classification models.       6. Strategy for missing data and imbalanced data.       7. Applied survival analysis to Data science |
| 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. Peter Bruce. & Andrew Bruce. *Practical Statistics for Data Scientists*, O'Reilly Media, Inc., 2017. 2. Gareth James, Daniela Witten, Trevor Hastie & Robert Tibshirani. *An Introduction to Statistical Learning with application in R, 2nd*, Springer, 2021. 3. Alan Agresti & Maria Kateri. *Foundations of Statistics for Data Scientists*, Chapman & Hall/CRC, 2022. 4. Hadley Wickham, Garrett Grolemund. *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data*, O'Reilly Media, Inc., 2016. |

#### Data Mining - MTH10358

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| Module designation | Data Mining |
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Assoc. Prof. Nguyen Thanh Binh |
| 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 | Fundamentals of Computer Programming (MTH00055) |
| Module objectives/intended learning outcomes | After successfully completing this course, students will be able to:   * + - 1. Analyze data and carry out the steps of the data mining process       2. Understand and apply data mining algorithms and tools that can be used to assist data analysts and data mining application developers       3. Explain common data mining tasks such as regression, classification, clustering, and association rule mining       4. 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. |

#### Python for Data Science - MTH10605

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| --- | --- |
| Module designation | Python for Data Science |
| Semester(s) in which the module is taught | 5th semester |
| Person responsible for the module | MSc. Ha Van Thao |
| 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 | 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:   * + - 1. Knowledge: Master the basics of python programming       2. Skills: analyzing and applying algorithms in practice       3. 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:   1. Rajeev Ratan, Data Science & Deep Learning for Business, Udemy, 2022. 2. tensorflow.org, tensorflow, <https://www.tensorflow.org/tutorials>, 2019. 3. keras.io, keras, https://keras.io/, 2019. 4. Scikit-learn.org, scikit-learn, <https://scikit-learn.org/stable/tutorial/index.html>, 2019. |

### 2.2.2 Specialization in Mathematical Methods in Computer Science

#### Image Processing and Analysis - MTH10317

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| Module designation | Image Processing and Analysis |
| Semester(s) in which the module is taught | 5th semester |
| Person responsible for the module | Dr. Tran Anh Tuan |
| 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)  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 | Data Structures and Algorithms (MTH10405) |
| Module objectives/intended learning outcomes | General objectives: to be familiar with image processing and analysis.  Specific objectives/course learning outcomes:   1. Knowledge: Presenting from the most basic concepts of image processing to processing methods in gray and color images, such as noise filtering methods, edge highlighting, morphological operations, wavelets, image segmentation, find edges and polygons and describe them. And the methods of image compression as well as basic watermarking techniques. 2. Skills: research and work in the field of image processing and analysis. 3. Attitude: Attend all classroom sessions, and discussions outside of class time. |
| Content | This module includes the following topics:   1. An overview and basic knowledge of digital images 2. Intensity Transformation and Filtering 3. Filtering in the frequency domain 4. Restoration and reconstruction of image 5. Color image processing 6. Wavelet transform and multi-resolution processing 7. Image Compression 8. Image processing using morphological math 9. Image Segmentation 10. Performance and description |
| Examination forms | Class discussion; 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 | Main textbook:   1. Rafael C. Gonzalez, Richard E. Woods, Digital image processing, Pearson, 2010. 2. William K. Pratt, Digital image processing, Wiley-Interscience, 1999.   References:   1. Ngo Dien Tap, Processing English by Computer, Science and Technology Publishing House, Hanoi 1997. 2. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Third Edition 2007. 3. William K. Pratt, Digital Image Processing, Fourth Edition, John Wiley and Sons Ltd, 2007. 4. John C. Russ, The Image Processing Handbook, Third Edition, CRC Press, 1999. 5. Maria Petrou and Panagiota Bosdogianni, Image Processing the Fundamentals, John Wiley and Sons Ltd, 1999. 6. S. Marchand-Maillet and Y. M. Charaiha, Binary Image Processing, Academic Press, 2000. 7. Loannis Pitas, Digital Image Processing Algorithm, Prentice Hall, 1993. 8. Scott.E.Umbaugh, "Computer Vision and Image Processing", Prentice Hall, 1997. |

#### Introduction to Artificial Intelligence - MTH10318

(see description of [this module](#bookmark=id.2p2csry) in Specialization in Data Science)

#### Introduction to Cryptography - MTH10319

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| Module designation | Introduction To Cryptography |
| Semester(s) in which the module is taught | 7th 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 |
| 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 | 1. Basic concepts of classical cryptographic theory. 2. Common symmetric cryptosystems: DES, AES. 3. Common cryptographic hash functions: MD5, SHA1. 4. Common public cryptosystems: RSA, ElGamal, ECC. 5. Diffie-Hellman key exchange protocol 6. Digital signatures: RSA, DSA, ECC. 7. 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](http://www.cacr.math.uwaterloo.ca/hac/) , CRC Press, 2001. 3. Pham Huy Dien, Ha Huy Khoai, Information Coding: Mathematical foundations and applications, National University Publishing House, Hanoi, 2003. |

#### Digital Signal Processing - MTH10320

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| Module designation | Digital Signal Processing |
| Semester(s) in which the module is taught | 5th semester |
| Person responsible for the module | MSc. Nguyen Ngoc 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 basic 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. |

#### High Performance Computing - MTH10321

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| Module designation | High Performance Computing |
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Assoc. Prof. Nguyen Thanh Binh |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lecture, lab work |
| 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 (MTH10406)  Discrete Mathematics (MTH10406)  Object-Oriented Programming (MTH10407) |
| 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. |

#### Arithmetic and Algorithms - MTH10324

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| Module designation | Arithmetic and Algorithms |
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Dr. Tran Nam Dung |
| 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 | Abstract Algebra (MTH00031) |
| 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, elliptical curves, algorithms deterministic and probabilistic primes testing, integer analysis, and discrete logarithms. |
| Content | 1. Recall the basics of algorithms and complexity. 2. Integer representation, prime numbers, Euclidean division algorithm, Chinese remainder theorem, Fermat's theorem, and continuous fractions 3. Euler nonfunctions, Mersenne primes, primitive roots 4. Squared residuals, Legendre notation, Jacobi notation 5. Prime number checking algorithms, prime number analysis 6. Elliptic curves over real numbers and over finite fields 7. Apply arithmetic to cryptographic theory: Caesar cipher system, RSA, ElGamal. 8. Algorithms 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> |

#### Algorithm Analysis - MTH10325

(see description of [this module](#bookmark=id.4bvk7pj) in Specialization in Data Science)

### 2.2.3. Specialization in Applied Mathematics and Informatics

#### Object-oriented software development - MTH10308

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| Module designation | Object-Oriented Software Development |
| Semester(s) in which the module is taught | 5th semester |
| Person responsible for the module | MSc. Pham Thi Vuong |
| 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:   1. 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,). 2. Skills: research and work in the field of object-oriented software development. 3. 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 | 1. Analytical and design skills (30%). 2. Skills in implementation, implementation, and testing (30%). 3. Document design skills (20%) 4. 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:   1. Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides. Design Patterns, Addison-Wesley, 1995. 2. Martin Fowler. UML Distilled, 3rd edition, Addison-Wesley, 2004. |

#### System and Network Administration - MTH10309

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| Module designation | System and Network Administration |
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Dr. Vo Duc Cam Hai |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| 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)  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 Networks (MTH10311) |
| Module objectives/intended learning outcomes | General objectives: To be familiar with system and network administration.  Specific objectives/course learning outcomes:   1. Knowledge: Provides knowledge about network services and principles of network administration in general. 2. 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. 3. Attitude: Attend all classroom sessions, and discussions outside of class time. |
| Content | This module includes the following topics:   1. 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. 2. 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. 3. Chapter 3: Focus on configuring network parameters, learn some commands to look up network information, and then learn network security knowledge by firewall. 4. Chapter 4: Understanding the role of services on the internet. Conduct research and test software such as bind, vsftp, apache, postfix, courier, openssh. 5. 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. 6. 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:   1. Steve Frampton, Unix/Linux System Administration Made Easy, Linux Documentation Project, 1999. 2. Olaf Kirch, Terry Dawson, Unix/Linux Network Administrator's Guide, O'Reilly, 2000. 3. Matthias Kalle Dalheimer, Matt Welsh, Running Unix/Linux, Fifth Edition, O’Reilly, 2005. |

#### .Net Programming - MTH10310

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| Module designation | .NET Programming |
| Semester(s) in which the module is taught | 5th semester |
| Person responsible for the module | Dr. Tran Anh Tuan |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lecture, lab work, 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 (MTH10407) |
| 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 |

#### Computer Networks - MTH10311

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| Module designation | Computer Networks |
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Dr. Vo Duc Cam Hai |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lecture |
| Workload (incl. contact hours, self-study hours) | 150 Hours  Contact hours:  Lectures: 45 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:   1. 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. 2. 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. 3. 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. |

#### Introduction to Database systems - MTH10312

(see description of [this module](#bookmark=id.1pxezwc) in Specialization in Data Science)

#### UNIX operating system - MTH10313

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| Module designation | UNIX Operating System |
| Semester(s) in which the module is taught | 5th semester |
| Person responsible for the module | Dr. Vo Duc Cam Hai |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lecture |
| Workload (incl. contact hours, self-study hours) | 150 Hours  Contact hours:  Lectures: 45 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 | 1. Unix/Linux OS installation process. 2. Use Unix/Linux to serve end users:    1. Unix/Linux external architecture overview.    2. Basic utility programs in Unix/Linux.    3. Install/compile software packages in Unix/Linux.    4. Computer system administration. 3. Using Unix/Linux to serve shell programmers:    1. Do the basics with Shells. Introduction of themes and corresponding usage scripts.    2. Shell programming. Work with the Shells Script programming language and build application programs. 4. Using Unix/Linux to serve system programmers (C programmers):    1. An overview of how to build and compile C programs in Unix/Linux.    2. Overview of the internal architecture of the Unix/Linux OS (Unix/Linux Internal). 5. 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. |

#### Software Project Management - MTH10314

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| Module designation | Software Project Management |
| Semester(s) in which the module is taught | 8th semester |
| Person responsible for the module | MSc. Nguyen Hien Luong |
| 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. |

#### Analysis and Design of Information Systems - MTH10315

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| Module designation | Analysis and Design of Information Systems |
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | MSc. Nguyen Hien Luong |
| 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 (MTH10312)  Object-oriented Programming (MTH10407) |
| 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 | 1. Method of surveying the current situation and understanding the needs. 2. Structured analysis (SA). 3. Linked entity data model, relational data model. 4. SART method. 5. 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. |

#### Java programming - MTH10316

|  |  |
| --- | --- |
| Module designation | Java Programming |
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Dr. Nguyen Tan Trung |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lecture, lab work |
| 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 (MTH10407) |
| 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. and 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* |

## 2.3. Elective Courses for Specialization

#### 1. Multidimensional Signal Processing – MTH10323

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| Module designation | Multidimensional Signal Processing |
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Dr. Kha Tuan 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 (MTH00030)  Measure Theory and Probability (MTH10401)  Mathematical Statistics (MTH10404) |
| 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 methods, 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:   1. Knowledge: Master the basic knowledge of multidimensional processing 2. Skills: analyse and apply algorithms in practice 3. 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. |

#### 2. Algorithm Analysis – MTH10325

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| Module designation | Algorithm Analysis |
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Assoc. Prof. Nguyen Thanh Binh |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | Lecture, lab work, 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 (MTH10406) |
| 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 | 1. Overview of the algorithm and its complexity 2. Generative functions and applications 3. Permutations and applications 4. 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. |

#### 3. Database Management System – MTH10344

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| Module designation | Database Management System |
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Dr. Tran Anh Tuan  Ms. Nguyen Hien Luong |
| 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 (MTH10312) |
| 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, decentralization 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. |

#### 4. Advanced Machine Learning – MTH10354

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| Module designation | Advance Machine Learning |
| Semester(s) in which the module is taught | 7th Semester |
| Person responsible for the module | Dr. Pham The Bao |
| 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.   1. Knowledge: mastering advanced knowledge of machine learning. 2. Skills: cognitive and practical abilities to use this knowledge in practical problems. 3. 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-depending 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:  Trần Trọng Khiêm, Statistical Machine Learning Approaches to Credit Risk, 2015. |

#### 5. Seminar on Data Science – MTH10620

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| Module designation | Seminar on Data Science |
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Assigned lecturers of the Faculty of Mathematics and Computer Science, University of Science, VNU-HCM |
| 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 (6.5 ECTS) |
| Required and recommended prerequisites for joining the module | None |
| 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:   1. Knowledge: provides additional knowledge that is more extensive than the subjects in the major. 2. 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:   1. Issues that have not been mentioned in the subjects of the major. 2. Problems arise in specialised subjects but have not been resolved. 3. The necessary knowledge is not included in the program to prepare for the expected graduation thesis topic. 4. The problems of the subject will be assigned by the lecturer for students to explore, research and present. Applicable forms: 5. Under the guidance of instructors, students choose a topic and register for research tasks, then report back. Instructors analyse and evaluate results. 6. 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 | Depends on the assigned topics. |

#### 6. Data Visualization – MTH10608

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| Module designation | Data Visualization |
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Dr. To Duc Khanh |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | Lecture, lab work, group work |
| 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 | The course provides students with a comprehensive understanding of data visualization. It equips them with the skills to identify data types and select appropriate methods and tools for visually representing data in a clear and intuitive manner, maximizing support for further analytical insights. Additionally, students will develop proficiency in using Power BI for data visualization.  Knowledge: Gain a solid understanding of the fundamental principles of data visualization and the various types of charts used in the process.  Skills & competences: Apply core principles effectively to create suitable visual representations. Develop the ability to choose the right chart for different data types and analytical purposes. Gain proficiency in using Power BI to create visualizations. Through laboratory activities and group work, the student will be able to:   1. recognize and appropriately describe the case study. 2. identify the appropriate visualiazion methods. 3. teamwork. 4. develop visualiazion skills and independent judgment. 5. develop communication skills. |
| Content | This module includes the following topics:   1. Introduction to data visualization (coordinate systems and axes, color scales). 2. Visualizing a single variable (quantitative and qualitative variable: amount, proportion). 3. Visualizing multiple variables (scatterplots, correlograms, dimension reduction). 4. Visualizing trends (smoothing, time-series). 5. Visualizing uncertainty (distribution, confidence regions). |
| 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. Claus O. Wilke. Fundamentals of Data Visualization, O’Reilly Media, 2019. 2. Knaflic, Cole Nussbaumer. Storytelling with Data: A Data Visualization Guide for Business Professionals, 2015. 3. Devin Knight, Erin Ostrowsky, Mitchell Pearson, Bradley Schacht. Microsoft Power BI Quick Start Guide: The Ultimate Beginner's Guide to Data Modeling, Visualization, Digital Storytelling, and More. Packt Publishing Limited, 2022. |

#### 7. Numerical Methods for Data Science – MTH10607

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| Module designation | Numerical Methods for Data Science |
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Dr. Nguyen Thi Hoai Thuong |
| 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:   1. Knowledge: Master the basic knowledge of numerical methods in data science 2. Skills: analyse and apply algorithms in practice 3. 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. |

#### 8. Pattern Recognition – MTH10322

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| Module designation | Pattern Recognition |
| Semester(s) in which the module is taught | 5th semester |
| Person responsible for the module | Dr. Tran Anh Tuan |
| 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 | None |
| Module objectives/intended learning outcomes | This course provides fundamental knowledge of pattern recognition with examples from many applications, multidimensional data processing techniques, classification and regression algorithms as well as data clustering.    Knowledge: familiarity with fundamental knowledge of pattern recognition such as multidimensional data processing techniques, classification algorithms, regression and data clustering  Skills and competences: cognitive and practical abilities to use the knowledge in pattern recognition field, artificial neural network, SVM (support vector machine) and computer vision |
| Content | This module includes the following topics:   1. Basic concepts in pattern recognition 2. Bayesian discrimination principle 3. Parameter estimation 4. Non-parametric techniques 5. Linear discriminants 6. Support Vector Machine 7. Artificial Neural Network 8. Algorithm-independent machine learning 9. Unsupervised learning and clustering 10. Final Project |
| 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 compulsory and greater or equal to 5.0/10.0. |
| Reading list | Main book: Pattern Classification (2nd Ed.), R. O. Duda, P. E. Hart and D. Stork, Eiley 2002.  References:   1. Pattern Classification (2nd Ed.), R. O. Duda, P. E. Hart and D. Stork, Eiley 2002. 2. Pattern Recognition and Machine Learning, C. Bishop, Springer 2006. 3. The Elements of Statistical Learning (2nd Ed.), T. Hastie, R. Tibshirani, J. Friedman, Springer 2009. |

#### 9. Software Testing 1 – MTH10332

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| Module designation | Software Testing 1 |
| Semester(s) in which the module is taught | 4th semester |
| Person responsible for the module | MSc. Nguyen Dat Thong |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | Lecture; Lab Works |
| 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:   1. 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. 2. Skills: research and work in the field of software testing. 3. 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:   1. Cem Kaner, Jack Falk and Hung Q. Nguyen, Testing Computer Software, 2nd Edition, Wiley, 1999. |

#### 10. Software Testing 2 – MTH10336

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| Module designation | Software Testing 2 |
| Semester(s) in which the module is taught | 5th semester |
| Person responsible for the module | MSc. Nguyen Dat Thong |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | Lecture; Lab Works |
| 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 | Software Testing; Object Oriented Programming |
| Module objectives/intended learning outcomes | General objectives: To be familiar with software test automation and techniques in automated software testing.  Specific objectives/course learning outcomes:   1. Knowledge: Mastering the knowledge of software test automation and techniques in automated software testing, thereby understanding the importance of automated software testing in the software development process; Understand the role and work of automation testing engineers. 2. Skills: research and work in the field of software testing automation. 3. Attitude: Attend all classroom sessions, and discussions outside of class time. |
| Content | This module includes the following topics:   1. Overview of automated software testing 2. Automated unit testing with xUnit 3. Automated testing with Microsoft CodedUI 4. Automate testing of Web applications with Selenium 5. Automated performance testing with Microsoft Visual Studio |
| Examination forms | Class discussion; 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 practice exam: 50%  Final theory exam: 50%  Final score is greater or equal to 5.0/10.0 |
| Reading list | Main textbook: Hung Q. Nguyen, Bob Johnson, Michael Hackett and Robert Johnson, Kiểm thử các ứng dụng web, NXB ĐHQG TPHCM, 2010.  References:   1. Cem Kaner, Jack Falk and Hung Q. Nguyen, Testing Computer Software, 2nd Edition, Wiley, 1999. 2. Selenium HQ: <http://docs.seleniumhq.org/docs/> 3. JUnit: <http://junit.org/junit4/> 4. NUnit: <https://www.nunit.org/index.php?p=documentation> 5. CodedUI Test: <https://msdn.microsoft.com/en-us/library/dd286726.aspx> |

#### 11. Introduction of Machine Learning – MTH10353

(see description of [this module](#_heading=h.4fsjm0b) in Specialization in Data Science)

#### 12. Mobile Computing – MTH10355

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| Module designation | Mobile Computing |
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Dr. Tran Anh Tuan |
| 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 | None |
| 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:   1. Knowledge: get familiar with knowledge of mobile computing 2. Skills: cognitive and practical abilities to use this knowledge in practical problems. 3. Attitude: Have the right attitude, perspective and awareness about the course. |
| Content | This module includes the following topics:   1. Section 1: What is Mobile Computing? An Overview 2. Section 2: Wireless Generations: An Overview 3. Section 3: Mobile Communications & Networks 4. Section 4: Media access methods: Space, time, frequency, & Code Division. 5. Section 5: Cellular Concept, System Design issues, satellites. 6. Section 6: GSM (Global System for Mobile Communications). 7. Section 7: Portable information appliances: laptops, notebooks, sub- notebooks, and MNCs hand-held computers PDAs and smartphones. 8. Section 8: Internet: TCP/ IP & de- facto application protocols. 9. Section 9: Desktop Vs Mobile Device architectures. ARM architecture. What makes the mobile environment different? 10. Section 10: Software architecture for mobile computing. 11. Section 11: Mobile Operating Systems (Android and iOS) 12. Section 12: Security in Mobile Systems. 13. 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: Jochen Schiller, Mobile Communications, 2nd edition, ISBN-13: 007-6092019329. |

#### 13. Seminar of Applied Mathematical Computer Science – MTH10326

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| Module designation | Seminar on Applied Mathematical Computer Science |
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Assigned lecturers of the Faculty of Mathematics and Computer Science, University of Science, VNU-HCM |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | Seminar; Project |
| Workload (incl. contact hours, self-study hours) | 160 Hours  Contact hours:  Lectures: 45 hours (in class)  Discussion: 30 hours (in class)  Private study: 85 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: Equipping students with basic knowledge to prepare for graduation thesis.  Specific objectives/course learning outcomes:   1. Knowledge: Master the basic knowledge to prepare for graduation thesis. 2. Skills: basic skills to prepare for graduation thesis. 3. 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 | Depends on the assigned topics. |

#### 14. Image Transformation and Processing – MTH10331

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| Module designation | Image Transformation and Processing |
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Dr. Pham The Bao  Dr. Tran Anh Tuan |
| 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 | None |
| 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:   1. Knowledge: Mastering the basic knowledge of image transformation and processing. 2. Skills: Analyse and apply algorithms in practice. 3. 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: Francis S Hill, Computer graphics, 1990. |

#### 15. Design and Build Web Applications – MTH10333

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| Module designation | Design and Build Web Applications |
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | M.S. Vo Duc Cam Hai  M.S. Tran Anh Tuan |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | Lecture; Lab Works |
| 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 | Fundamentals of Computer Programming (MTH00055) |
| 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:   1. Knowledge: Master web application architecture, website design process, website building tools and languages. 2. Skills: survey, analysis, design, interface building and website deployment. 3. 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: Open-source web design documents, http://www.w3schools.com |

#### 16. Web Programming with PHP – MTH10337

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| Module designation | Web Programming with PHP |
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | M.S. Tran Anh Tuan  M.S. Nguyen Dat Thong |
| 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)  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 (MTH10312) |
| 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:   1. Knowledge: Mastering the knowledge of building web applications. 2. Skills: survey, analyze, design, build, deploy and maintain websites. 3. 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:  Refenes Data, Lectures on open-source PHP, <http://www.w3schools.com>, 2010 |

#### 17. Pattern Recognition and Analysis – MTH10340

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| Module designation | Pattern Recognition and Analysis |
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Dr. Pham The Bao  Dr. Huynh Trung Hieu |
| 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)  Lab Works: 30 hours (in class)  Practice: 30 hours (in class)  Private study: 60 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: Introduce 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 join this course.  Specific objectives/course learning outcomes:   1. Knowledge: Master the basic knowledge of image transformation and processing. 2. Skills: analyze and apply algorithms in practice. 3. 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. Introduce 2. Bayesian discrimination principle. 3. Parameter estimation 4. Non-parametric techniques 5. Linear discriminants 6. Artificial Neural Network 7. Support Vector Machine 8. Algorithm independence in machine learning 9. Unsupervised learning and clustering |
| 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. Richard O. Duda, Peter Elliot Hart and David G. Stork, Pattern classification, Wiley-Interscience, 2004. 2. C. Bishop, Pattern Recognition and Machine Learning, Springer, 2007   References:  Trevor Hastie, Robert Tibshirani and Jerome Friedman, *The Elements of Statistical Learning: Data Mining, Inference, And Prediction*, Springer, 2009. |

#### 18. Seminar on Computer Science - MTH10346

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| Module designation | Seminar on Computer Science |
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Assigned lecturers of the Faculty of Mathematics and Computer Science, University of Science, VNU-HCM |
| 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 (6.5 ECTS) |
| Required and recommended prerequisites for joining the module | None |
| 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:   1. Knowledge: provides additional knowledge that is more extensive than the subjects in the major. 2. 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:   1. Issues that have not been mentioned in the subjects of the major. 2. Problems arise in specialised subjects but have not been resolved. 3. The necessary knowledge is not included in the program to prepare for the expected graduation thesis topic. 4. The problems of the subject will be assigned by the lecturer for students to explore, research and present. Applicable forms: 5. Under the guidance of instructors, students choose a topic and register for research tasks, then report back. Instructors analyse and evaluate results. 6. 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 topics. |

#### 19. Web Programming with J2EE - MTH10334

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| Module designation | Web Programming with J2EE |
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | M.Sc. Ha Van Thao  M.Sc. Vo Duc Cam Hai |
| 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)  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 (MTH10312)  Java Programming (MTH10316) |
| Module objectives/intended learning outcomes | General objectives: Provide students with the knowledge to develop web applications using Java Enterprise Edition:   1. Servlet, JSP to build web applications 2. Concepts of Cookie, Session 3. MVC framework 4. JDBC, EL, …   Specific objectives/course learning outcomes:   1. Knowledge: Mastering the knowledge of building web applications. 2. Skills: survey, analyse, design, build, deploy and maintain websites. 3. 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. Servlet Technology 2. Form Processing 3. Header Processing 4. Cookie 5. Session Tracking 6. JSP Technology 7. Java Bean 8. MVC Framework 9. Expression Language |
| Examination forms | Midterm and final exam: written exams |
| Study and examination requirements | Midterm exam: 50%  Final exam: 50%  Final score is greater or equal to 5.0/10.0 |
| Reading list | Main textbook:   1. Core Servlets and JavaServer Pages, Marty Hall, Prentice Hall. 2. Core Servlets and JavaServer Pages: Advanced Technologies, Vol. 2, Marty Hall & Larry Brown, Prentice Hall.   References:  Developing Enterprise Java Applications with J2EE and UML, Khawar Zaman Ahmed & Cary E. Umrysh, Addison-Wesley. |

#### 20. Natural Language Processing - MTH10359

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| Module designation | Natural Language Processing |
| 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, lesson, lab work, project. |
| Workload (incl. contact hours, self-study hours) | 60, 120 ??? |
| Credit points | 4 Credits (6.5 ECTS) |
| Required and recommended prerequisites for joining the module | Introduction to Machine Learning (MTH10353)  Introduction to Artificial Intelligence (MTH10318) |
| Module objectives/intended learning outcomes | Equip students with the basic knowledge of natural language processing (NLP), the methods and techniques used in NLP, along with fundamental mathematical models applied to text processing tasks in non-random contexts. |
| Content | Including the theory of natural language processing (NLP) models, syntactic and semantic analysis, language generation, and the impact of computational methods and algorithms in NLP applications. |
| Examination forms | lab work and oral presentation |
| Study and examination requirements | lab works: 30%, oral presentation: 70% |
| Reading list | 1. Natural Language Processing with Python, Steven Bird, Ewan Klein, and Edward Loper, O’Reilly Media. 2. Representation Learning for Natural Language Processing, Zhiyuan Liu, Yankai Lin, Maosong Sun, Springer 2023. 3. Deep Learning for Natural Language Processing, Stephan Raaijmakers, Manning 2022 |

#### 21. Optimization Algorithms – MTH10450

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| Module designation | Optimization Algorithms |
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Assoc. Prof. Vo Si Trong Long |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lecture, lab work, 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 | 1. Basic properties and concepts of algorithms, Direct/Indirect line search method for unconstrained optimization problem. 2. Deep reduction method, gradient method and conjugate gradient method. 3. Newton and quasi-Newton methods. 4. 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. |

#### 22. Multivariate Statistics - MTH10619

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| Module designation | Multivariate Statistics |
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Dr. Nguyen Thi Mong Ngoc |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| 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 or Python programming in analyzing the 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 (or Python) programming in analyzing the real data. |
| Examination forms | Written exams |
| 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. |

# **3. Graduation knowledge**

#### 1. Graduation Thesis – MTH10595

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| Module designation | Graduation Thesis |
| 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, University of Science, VNU-HCM |
| 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:   1. Point out the research problems 2. Apply fundamental knowledge and theories to analyse the research problem; develop a research framework (model if applicable); and design a solution for the problem 3. Use appropriate techniques for solutions 4. Demonstrate the scientific contribution and practical relevance of the research carried out 5. Provide a consistent, well-structured Bachelor Thesis 6. Plan and manage learning process 7. 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 supervisors |

#### 2. Internship – MTH10549

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| --- | --- |
| Module designation | Internship |
| 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, University of Science, VNU-HCM |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| 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 Credits (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:   1. Apply knowledge, skills in mathematics/applied mathematics/computer science to practice with real-life problems in company, industry. 2. Self-orient in the desired professional field. 3. Understand the impact of mathematics and computer science in a global, economic, environmental, and societal context. 4. Conduct work responsibly in cooperation with others. 5. Write and present a report in adequate format. |
| Content | 1. Attendance: Students should attend 100%. Attendance will be regulated and checked. 2. Individual Assignments: Tasks are assigned by the industrial company. 3. 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. |

#### 3. Surveys of Mathematics, Computer Science, and Specializations – MTH10617

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| Module designation | Surveys of Mathematics, Computer Science, and Specializations |
| Semester(s) in which the module is taught | 4th semester |
| Person responsible for the module | Assigned lecturers of the Faculty of Mathematics and Computer Science, University of Science, VNU-HCM |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | Lectures, group work |
| Workload (incl. contact hours, self-study hours) | Total workload: 90 hours  Contact hours (lectures, exercises): 30 hours  self-study: 60 hours |
| Credit points | 2 Credits (3 ECTS) |
| Required and recommended prerequisites for joining the module | None |
| Module objectives/intended learning outcomes | General Objective: The course aims to provide students with a broad understanding of mathematics, computer science, and related majors in the training program. This foundation helps students orient themselves and make informed decisions when selecting their major.  Specific Objectives / Course Learning Outcomes:   * Knowledge: Students will gain an overview of mathematics, computer science, and related majors, along with their applications and career opportunities. * Skills: Gaining a general understanding of a field. * Attitude and Diligence: Seriousness, diligence, and a scientific approach. |
| Content | The course consists of lectures and activities conducted by multiple instructors, providing an overview of mathematics and computer science, their history worldwide, and the current state in Vietnam. It also introduces various majors, including their focus, research scope, applications, and career opportunities. Students engage actively, provide feedback, and undergo assessments. |
| Examination forms | Written exams |
| Study and examination requirements | Tests – process score: 70%  Final exam: 30 % |
| Reading list | 1. Lịch sử Toán học, Nguyễn Phú Lộc, NXB Giáo Dục, 2008. 2. The History of the Development of Information Technology and its Organizational and Societal Impact. M.C. Mr, 2013. 3. Lecture notes. |