VIETNAM NATIONAL UNIVERSITY, HO CHI MINH CITY
UNIVERSITY OF SCIENCE
FACULTY OF MATERIALS SCIENCE AND TECHNOLOGY

MODULE HANDBOOK

Bachelor of Science in Materials Technology

Contents

1. Marxist-Leninist Philosophy

Module designation	**Marxist-Leninist Philosophy**, BAA00101
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Giang Thi Truc Mai, MSc
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, brainstorming, group discussion
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 45 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	4.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- Students are able to understand the basic contents of the worldview and the Marxist-Leninist philosophical methodology. - Students apply knowledge about the worldview, MarxistLeninist philosophy, and philosophy creatively in cognitive and practical activities, to solve problems that affect the social life of a country or of the time being set.
Content	Introduction (1 hours)

	Chapter 1: Philosophy and its role in social life (15 hours) Chapter 2: Dialectical Materialism (15 hours) Chapter 3: Historical Materialism (14 hours)
Examination forms	- Presentation: 15% - Midterm exam (essay): 20% - Discussion: 15% - Final exam (essay): 50%
Study and examination requirements	- Minimum attendance of lectures is about 80% - Attend all reporting sessions, actively discuss, and submitall assignments
Reading list	1. Ministry of Education and Training, 2009. Textbook of basic principles of Marxism-Leninism. National Political Publishing House. 2. Ministry of Education and Training, 2021. MarxistLeninist Philosophy Syllabus. National Political Publishing House.

2. Marxist-Leninist Political Economy

Module designation	**Marxist-Leninist Political Economy** , BAA00102
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Quach Thi Minh Trang, PhD
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, brainstorming, group discussion
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	Marx-Lenin philosophy (BAA00101)
Module objectives/intended learning outcomes	- Students are able to understand basic and core knowledge of Marxist-Leninist political economy in the context of economic development of the country and the world today. Ensure the basic, systematic, scientific, update new knowledge, associate with practice, creativity, skills, thinking, learner quality, connectivity to overcome duplication, enhance integration and reduce the load, reduce content that is no longer relevant or scholastic content for

	students of non-theoretical colleges and universities. - Second, on that basis, students are 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, students are able to contribute to building the stance and ideology of Marxism-Leninism towards students
Content	Chapter 1: Objects, research methods and functions of the Marxist-Leninist political economy (2 hours) Chapter 2: Commodities, markets and the role of market participants (6 hours) Chapter 3: Surplus value in a market economy (7 hours) Chapter 4: Competition and Monopoly in a Market Economy (5 hours) Chapter 5: Socialist-oriented market economy and economic interests in Vietnam (5 hours) Chapter 6: Vietnam's industrialization, modernization and international economic integration (5 hours)
Examination forms	- Presentation: 15% - Midterm exam (essay): 20% - Discussion: 15% - End semester exam (essay): 50%
Study and examination requirements	- Minimum attendance of lectures is about 80%. - Attend all presentations, actively discuss, submit all assignments.
Reading list	1. Ministry of Education and Training, 2019. MarxistLeninist political economy textbook for undergraduates who do not specialize in political economy. National

	Political Publishing House

3. Scientific Socialism

Module designation	**Scientific Socialism** , BAA00103
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	Giang Thi Truc Mai, MSc
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, brainstorming, group discussion
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- Students know the basic contents of scientific socialism (one of the three components constituting MarxismLeninism). - Students know how to apply basic knowledge of scientific socialism creatively in cognitive and practical activities, solving problems that affect the social life of a country, of the times being set.
Content	Introduction (3 hours) Chapter 1: Introduction to Scientific Socialism (3 hours)

	Chapter2: The historical mission of the working class (3 hours) Chapter 3: Socialism and the transition to socialism (5 hours) Chapter 4: Socialist democracy and the socialist state (5 hours) Chapter 5: Class social structure and class and class alliances in the transition to socialism (5 hours) Chapter 6: Ethnic and religious issues in the transition to socialism (3 hours) Chapter 7: The problem of the family during the transition to socialism (3 hours)
Examination forms	- Presentation: 15% - Midterm exam (essay): 20% - Discussion: 15% - End semester exam (essay): 50%
Study and examination requirements	- Minimum attendance of lectures is about 80%. - Attend all presentations, actively discuss, submit all assignments.
Reading list	1. Ministry of Education and Training, 2021. Scientific Socialism Curriculum. National Political Publishing House. 2. Ministry of Education and Training, 2018. Textbook Basic principles of Marxism-Leninism. National Political Publishing House.

4. History of the Communist Party of Vietnam

Module designation	**History of the Communist Party of Vietnam** , BAA00104
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	Phan Thi Cam Lai, MSc
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, brainstorming, group discussion, learning through videos
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- Students know the 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 defence during the country's transition to socialism. association, conducting the

	renovation work (1975-2018). - Through historical events and experiences on the leadership of the Party, students know how to build a sense of respect for objective truths, raise pride and confidence in the Party's leadership. - Students know how to scientific thinking methods on history, skills in choosing research materials, studying subjects and the ability to apply historical awareness to practical work, criticising misconceptions on the history of the Party.
Content	Introduction: objects, functions, tasks, contents and methods of researching and studying the history of the Communist Party of Vietnam (6 hours) Chapter 1: The Communist Party of Vietnam was born and led the struggle for power (1930-1945) (12 hours) Chapter 2: The Party led two resistance wars, completed national liberation and reunification (1945-1975) (6 hours) Chapter 3: The Party led the country in the transition to socialism and carried out the doi moi (1975-2018) (6 hours)
Examination forms	- Presentation: 15% - Midterm exam (essay): 20% - Discussion: 15% - Final exam (essay): 50%
Study and examination requirements	- Minimum attendance of lectures is about 80%. - Attend all presentations, actively discuss, submit all assignments.
Reading list	1. Ministry of Education and Training, 2019. History of the Communist Party of Vietnam. National Political Publishing House

5. Ho Chi Minh's Ideology

Module designation	**Ho Chi Minh's Ideology** , BAA00003
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	Ngo Thi Kim Lien, PhD
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, brainstorming, group discussion
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- Students know the 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. - Students are able to think, analyse, evaluate, and creatively apply Ho Chi Minh's Thoughts to solve

	problems in real life, study and work. - Students are able to 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; realise their responsibility in studying and training to contribute to the construction and defence of the country.
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	- Presentation: 15% - Midterm exam (essay): 20% - Discussion: 15% - End semester exam (essay): 50%
Study and examination requirements	- Minimum attendance of lectures is about 80%. - Attend all presentations, actively discuss, submit all assignments.
Reading list	1. Ministry of Education and Training, 2019. Ho Chi Minh Thought Textbook, National Political Publishing House.

6. General Law

Module designation	**General Law** , BAA00004
Semester(s) in which the module is taught	1st semester
Person responsible for the module	Ha Minh Ninh, MSc
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, brainstorming, interrogation, group discussion, learning through videos
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 45 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	4.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	By the end of the course, students will be able to 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, analysing legal regulations, and working in groups, thereby improving their sense of survival, learning and working following the Constitution and regulations. The law, the

	right behaviour orientation in life. Specific objectives/course output standards: - 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; - Analysing legal regulations; lookup legal documents; teamwork - Attitude, diligence: Raise awareness of living, studying, and working following the Constitution and the law.
Content	Chapter 1: General introduction to state and law (8 hours) Chapter 2: State apparatus (8 hours) Chapter 3: Law - A tool to regulate legal relations (8 hours) Chapter 4: Laws in the legal system (16 hours) Chapter 5: General issues on anti-corruption (4 hours) Revision (1 hour)
Examination forms	- Progress Test: 10%, - Discussion, exercise, practice: 10% - Attendance: 10% - Mid term test (multiple choice): 20% - Final exam (multiple choice): 50%
Study and examination requirements	- Minimum attendance of lectures is about 80%. - Attend all presentations, actively discuss, submit all assignments.
Reading list	1. Phan Trung Hien et al., 2008. General Law Textbook. National Political Publishing House.

7. General Economics

Module designation	**General Economics** , BAA00005
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Le Nhan My, PhD
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, brainstorming, group discussion, learning through videos
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- Students are able to grasp the basic content of Microeconomics - a part of economics, understand the theory of economic choice, the influence of the law of scarcity, and economic models on economic choice; understand the theory of supply and demand, consumer behaviour, producer behaviour, competition and monopoly, factor markets, the role of government, understand the analysis of the influence of factors on the

	balance of the market, in terms of skills - Students have 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. - Students have the ability to apply the knowledge learned in the study of macroeconomics, development economics, and several other economic subjects. - Students form and develop (one step) capacity to collect information, skills to synthesise and systematise issues in an overall relationship; skills to compare, analyse, comment, and evaluate micro-economic issues. - Students have the ability to develop reasoning and public speaking skills. - Students have the ability 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. - Through presentations and problem-solving, students have the ability to form and develop collaboration and teamwork skills; develop skills of creative thinking, discovery, and discovery; cultivate and develop assessment and selfassessment capacity; develop public speaking and commenting skills.
Content	Chapter 1: Introduction (2 hours) Chapter 2: Supply, demand, and market prices (8 hours) Chapter 3: Consumer behaviour (6 periods) Chapter 4: Producer theory (6 periods) Chapter 5: Measuring national output, aggregate supply, aggregate demand (8 hours)
Examination forms	- Homework (exercise): 20%

	- Midterm exam (multiple choice): 20% - Final exam (essay): 60%
Study and examination requirements	- Minimum attendance of lectures is about 80%.
Reading list	1. Gregory Mankiw, 2003. Principles of economics, Statistics Publishing House. 2. Ministry of Education and Training, 2013. Microeconomics, Vietnam Education Publishing House

8. General Psychology

Module designation	**General Psychology** , BAA00006
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Tran Huong Thao, MSc
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Brainstorming, interrogation, group discussion, learning through videos
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- Students are able to understand the system of basic concepts of psychological science and research methods in psychology; the origin, formation and development of psychology and consciousness; the nature of human psychological processes: perception; emotion - affection; act. - Students have the ability to identify human psychological states.

	- Students have the ability to understand the psychological attributes that make up the personality structure; the factors affecting the formation and development of personality. - Students have the ability to form and develop the ability to identify psychological phenomena, and apply learned knowledge to solve practical problems. - Students have the ability to cultivate a passion for learning and studying subjects. Forming a sense of initiative and positivity in self-study, the right motivation in learning. Raise a sense of responsibility for group activities. - Students have the ability to form personality qualities in accordance with the requirements of the integration period; communication and behavioural skills in the community, a modern and scientific way of living and working; developing the ability to think creatively, independently and critically. - Students have the ability to practise reasoning skills; public speaking skills; form and develop teamwork skills.
Content	Chapter 1: General overview of psychology Chapter 2: Objects, tasks and research methods Chapter 3: Natural and social basis of formation and psychology, consciousness Chapter 4: The process of sensory perception Chapter 5: The process of rational perception Chapter 6: Memory and Attention Chapter 7: Emotions and feelings Chapter 8: Willpower Chapter 9: Personality
Examination forms	- Exercise (2 individual exercises + 2 group exercises): 30%;

	- Mid term test (multiple choice): 20% - Final exam (essay): 50%
Study and examination requirements	Minimum attendance of lectures is about 80%, active in discussion, and submit all exercises on time.
Reading list	1. Dang Thanh Nga, 2019. General psychology textbook. Police Publishing House.

9. Innovative Methodology

Module designation	**Innovative Methodology** , BAA00007
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Vuong Huynh Minh Triet, MSc
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, brainstorming, interrogation, group discussion, learning through videos
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- Students are able to systematise ways of looking at things ; logically analyse and interpret existing creative solutions ; acquire and value information more quickly; recognize the unifying similarity between seemingly very disparate systems. - Students are able to detect available reserves in the system, especially those that are free to use. - Students are able to solve the inconsistencies in the

	problem. - Students are able to provide and select appropriate approaches to solve the problem. - Students are able to develop ideas for system improvement. - Students are able to forecasting the development trend of the system in the future - Students are able to detect, place, and select the problem to be solved. - Students are able to improve themselves; build a scientific and creative thinking and working style. - Students are able to be systematic and dialectically
Content	The introduction chapter (2 hours) Chapter 1: Natural methods of problem-solving and decision making (2 hours) Chapter 2: Some scientific and technical knowledge is the basis of the subject (12 hours) Chapter 3: Some basic creative tricks (principles) (12 hours) Chapter 4: Methods of activating creative thinking (6 hours) Chapter 5: Rules of system development (10 hours) Summary (1 hours)
Examination forms	- Exercise: 20% - Mid term test (essay): 30% - Final exam (essay): 50%
Study and examination requirements	Minimum attendance of lectures is about 80%, active in discussion, and submit all exercises on time.
Reading list	1. Phan Dung, 2000. Scientific and technical innovation methodology - Problem solving and decision making.

10. Earth Science

Module designation	**Earth Science** , GEO00002
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Hoang Thi Phuong Chi, MSc
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Students are able to: - Knowledge: Earth Science is is an interdisciplinary science; the history of the formation of the Earth in the universe; internal and external geological processes; 4-spheres of earth; the interaction between human society and the Earth. - Skills:observing natural processes on earth. - Competences: to improve personal skills, attitudes and communication skills.

Content	- Earth in the universe - Structure and material of the Earth. - The internal and external geological processes - The atmostphere and the hydrosphere of the Earth. - Human and the earth.
Examination forms	- Assignments: 20% - Mid-term examination: 30% - Final examination: 50%
Study and examination requirements	Minimum attendance of lectures is about 80%, active in discussion, and submit all exercises on time.
Reading list	1. Lecture notes for the course. 2. Luu Duc Hai, Tran Nghi (2008). Earth science. 3. Edward J. Tarbuck, Frederick K. Lutgens (2012). Earth Science.

11. General Environmental Studies

Module designation	**General Environmental Studies** , ENV00001
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Dr. Le Tu Thanh
Language	Vietnamese
Relation to curriculum	TC2 course
Teaching methods	Lecture, group work, exercise
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- Describe the basic concepts of environment and resources - Describe the basic components of the natural environment - Presentation of the environmental issues in the world and in Vietnam - Impacts due to socio-economic activities on the environment - Presentation of basic solutions to protect the environment, conserve resources and sustainable development.
Content	Theory and exercise: 45 periods = 37.5 hours

	Chapter 1. Introduction of module (3 periods) Chapter 2. Basic components of the environment (6 periods) Chapter 3. Ecosystems and the application of ecological principles to the environment (6 periods) Chapter 4. Main types of ecosystems (6 periods) Chapter 5. Natural resources (3 periods) Chapter 6. Environmental pollution (6 periods) Chapter 7. Global climate change and environmental protection strategies (3 periods) Chapter 8. Population and environment (3 periods) Chapter 9. Environmental Management (3 periods) Chapter 10. Sustainable development and environmental protection (6 periods) Self study: 90 hours
Examination forms	Exercise (reports): 50 %; Final examination (Multi choice exam): 50 %
Study and examination requirements	Minimum attendance of lectures is about 80%, active in discussion, and submit all exercises on time.
Reading list	1. Le Van Khoa, Environmental Science, NXB Giáo Dục, 2005. 2. Goudie, A. The Human Impact on Natural Environment. 6th Edition. Oxford, Blackwell, 2006.

12. Laboratory Safety

Module designation	**Laboratory Safety** , MST00001
Semester(s) in which the module is taught	1st semester
Person responsible for the module	Phạm Huy Lâm; Tống Hoàng Tuấn; Trần Quang Minh
Language	Vietnamese
Relation to curriculum	TC2 course
Teaching methods	Lecture, labwork
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 0 hour(s) Laboratory: 15 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Students are able to: 1. Work safely in the Laboratory of Physics, Chemistry and Biology with an understanding of safety regulations. 2. Estimate and counter potential dangers when working in a laboratory using the basic knowledge and skills they are provided.
Content	1. General regulations of working in Laboratory 2. Safety in Chemistry Laboratory 3. Safety in Physics Laboratory

	4. Safety in Biology Laboratory 5. Emergency and reactions
Examination forms	Oral presentation (15%) Midterm exam (15%) Class assignment (30%) Final exam (40%)
Study and examination requirements	Attend all reporting sessions, actively discuss and submit all the assignment.
Reading list	1. Bui Nguyen Hùng, Nguyen Thuy Quynh Lona, Quality management systems, 2004, textbook, VNU-HCM Publishing 2. Samuel Kotz, Xizhi Wu, Norman L Johnson, Inspection errors for attributes in quality control, 1991, Chapman and Hall 3. Standards, Metrology and

13. Calculus 1B

Module designation	**Calculus 1B** , MTH00003
Semester(s) in which the module is taught	1st semester
Person responsible for the module	Cao Nghi Thuc, MSc
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, brainstorming, interrogation, group discussion
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 45 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	4.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- Students are able to major in natural sciences such as biotechnology, biology, geology, chemistry, etc. - Students have the general knowledge about the field of differential and integral calculus of functions of one variable. - Students are not only taught calculational skills but also equipped with one-variable calculus knowledge to assist students to apply mathematical logic thinking to further serve their majors.

	- Students are able to apply each subject in the course and will be integrated into the lectures so that students can understand the mathematical basis of a number of problems in their majors. - Students are able to understand, perform calculations competently, and orient the application of Calculus in the fields of training.
Content	Chapter 1: Real numbers, sequences, and series. (9 hours) Chapter 2: Functions of one variable - limits, and continuity of functions of one variable. (9 hours) Chapter 3: Differential calculus of functions of one variable. (9 hours) Chapter 4: Integral calculus functions of one variable. (9 hours) Chapter 5: Differential equations. (9 hours)
Examination forms	- Attendance: 5% - Exercise : 15% - Mid-term test (essay): 30% - Final exam (essay): 50%
Study and examination requirements	Minimum attendance of lectures is about 80%
Reading list	1. Duong Minh Duc, 2006. Analytical Mathematics Textbook 1, City Statistics Publishing House. HCM. 2. James Stewart, 2008. Calculus, early transcendental, 7 edition. Brooks Cole.

14. Advanced Mathematics C

Module designation	**Advanced Mathematics C** , MTH00002
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Nguyen Van Thuy, MSc
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, brainstorming, interrogation, group discussion
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 45 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	4.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- Students are able to major in natural sciences such as biotechnology, biology, geology, chemistry, etc. The course systematically equips students with general knowledge about the field of basic algebra such as determinants, matrices, systems of linear equations, differential and integral calculus of multivariable functions, etc… which, differential and integral calculus of multivariable functions is the expansion of the onevariable functions.

	- Students are not only taught calculational skills but also equipped with one-variable calculus knowledge to assist students to apply mathematical logic thinking to further serve their majors. Applications of each subject in the course will be integrated into the lectures so that students can understand the mathematical basis of a number of problems in their majors. After completing the course, students are able to understand, perform calculations competently, and orient the application of the acquired knowledge in the fields of training. - After completing the course, students are able to understand, perform calculations competently, and orient their application of the following units in the field of training.
Content	Chapter 1: System of linear equations (15 hours) 1.1 Matrix and matrix transformations. 1.2 Rank of matrix and inverse matrix 1.3 Determinants 1.4 System of linear equations Chapter 2: Calculus of functions of many variables (30 hours) 2.1. Function of two variables 2.2 Polar coordinate system 2.3 Limits of the functions of two variables 2.4 Partial derivatives - Directional derivatives 2.5 Differential and integral calculus of multivariable functions 2.6 Hidden-variable theorems
Examination forms	- Exercise: 20% - Attendance: 5% - Mid-term test (essay): 25%

	- Final exam (essay): 50%
Study and examination requirements	Minimum attendance of lectures is about 80%, submit all exercises on time
Reading list	1. Do Cong Khanh, 1999. Multivariable analysis. Ho Chi Minh City University of Natural Sciences Publishing House. 2. James Stewart, 2008. Calculus, early transcendental, 7 edition. Brooks Cole.

15. Probability and Statistics

Module designation	**Probability and Statistics** , MTH00040
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	Nguyen Van Thin, MSc
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, brainstorming, interrogation, group discussion
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 45 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	4.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- Students have the most basic knowledge and notions of probability and statistics to be background knowledge for later courses. - Students have the ability to employ probability and statistics to solve some real-world problems related to analysis and presentation of data. - Students know the initial knowledge of probability and statistics, and recognition of the role of probability and statistics in science and in life, from which an enthusiasm

	for science can be formed, then a serious and proactive attitude in study.
Content	Chapter 1: Combinatorics (2 hours) Chapter 2: Probability Basics (9 hours) Chapter 3: Random Variables (14 hours) Chapter 4: Descriptive Statistics (7 hours) Chapter 5: Hypothesis testing (9 hours) Chapter 6: Regression and correlation (4 hours)
Examination forms	- Attendance: 10% - Exercise: 10% - Midterm test (multiple choice): 20% - Final exam (multiple choice + essay): 60%
Study and examination requirements	Minimum attendance of lectures is about 80%, submit all exercises on time
Reading list	Nguyen Thi Mong Ngoc et al., 2018. Statistical probability. Ho Chi Minh City National University Publishing House.

16. General Chemistry 1

Module designation	**General Chemistry 1** , CHE00001
Semester(s) in which the module is taught	1st semester
Person responsible for the module	Nguyen Thai Ngoc Uyen, Vu Nang An Dau Tran Anh Nguyet, Bui Thi Thu Thao, Huynh Nguyen Thanh Luan
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, group work, exercise
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 30 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- Understand scientific research methodologies and recognize chemistry as a discipline based on scientific investigation results; distinguish the roles of theories and laws in the field of chemistry - Describe the electronic structure of atoms according to the modern atomic model - Apply the periodic law and basic modern theories of chemical bonding—including ionic, covalent, and metallic bonds—to distinguish among types of strong and weak

	bonds, and use these theories to explain and predict the fundamental properties of chemical substances. - Differentiate the strengths, weaknesses, and application scopes of the aforementioned basic bonding theories. - Utilize models of gases, liquids, and solids to explain and predict the fundamental properties of gases, liquids, and the primary types of crystal structures. - Explain the collective properties of non-electrolyte and colloidal solutions, and calculate thermodynamic parameters such as freezing point, boiling point, osmotic pressure, and vapor pressure of these solutions.
Content	Chapter 1. Course introduction – Fundamentals of atomic theory Chapter 2. Atomic shell structure – Bohr model – Quantum mechanics for the hydrogen atom-Atomic shell structure – Bohr model – Quantum mechanics for the hydrogen atom-Quantum theory for multi-electron atoms; Electron configurations Chapter 3. The periodic table and periodic law Chapter 4. Bonding theory: Metallic and ionic bonding; Covalent bonding – Lewis structures-VSEPR theory (Valence Shell Electron Pair Repulsion)-Introduction to Valence Bond (VB) theory: σ (sigma) and π (pi) bonds-VB theory: hybridization-Covalent bonding in crystal lattices; Molecular Orbital (MO) theory Chapter 5. Gaseous state – Gas laws Chapter 6. Liquid state – Intermolecular forces; Structure and properties of solids Chapter 7. Solutions
Examination forms	- Midterm examination (writing test): 25% - Exercise (tests): 15 % - Attendance (quizz): 10% - Final examination (writing test): 50 %

Study and examination requirements	Minimum attendance of lectures is about 80%, active in discussion, and submit all exercises on time.
Reading list	Petrucci, R.H; Harwood, W.S; Herring, F.G (2011, 10th Ed.). General Chemistry – Principles and modern applications. USA: Prentice Hall

17. General Chemistry 2

Module designation	**General Chemistry 2** , CHE00002
Semester(s) in which the module is taught	1st semester
Person responsible for the module	Hoang Thi Dong Quy, Pham Huy Lam, Nguyen Ngoc Thuy, Nguyen Tuong Vy
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, group work, exercise
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 30 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Calculate the heat effects associated with chemical and physical transformations. Determine the conditions under which reactions occur spontaneously and achieve chemical equilibrium. Analyze and calculate the factors affecting chemical equilibrium. Establish rate expressions and calculate the factors influencing reaction rates. Identify various types of equilibria in solutions and calculate the pH of solutions.

	Calculate the electromotive force (EMF) of electrochemical cells, predict the direction of redox reactions, and describe and explain natural corrosion processes
Content	The course deals with the following topics: Chapter 1: Chemical Thermodynamics – Energy Exchange and Chemical Transformations (8 periods) Chapter 2: Thermodynamics – Entropy, Free Gibbs Energy, and Spontaneity of Chemical Reactions (4 periods) Chapter 3: Chemical Kinetics – Reaction Rate and Mechanism (6 periods) Chapter 4: Chemical Equilibrium (6 periods) Chapter 5: Acid–Base Equilibria and Ionic Equilibria in Solution (10 periods) Chapter 6: Electrochemistry (6 periods)
Examination forms	- Midterm examination (writing test): 30% - Exercise (Quizz, in-class works): 15 % - Final examination (multiple choices test): 55 %
Study and examination requirements	Minimum attendance of lectures is about 80%, active in discussion, and submit all exercises on time.
Reading list	Ralph H. Petrucci (Author), F. Geoffrey Herring (Author), Jeffry D. Madura (Author), Carey Bissonnette (Author), General Chemistry: Principles and Modern Applications-10th Ed.

18. General Chemistry Lab 1

Module designation	**General Chemistry Lab 1** , CHE00081
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	Vu Nang An
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Labwork
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 0 hour(s) Exercise: 0 hour(s) Laboratory: 60 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	4 ECTS
Required and recommended prerequisites for joining the module	General Chemistry 1; General Chemistry 2
Module objectives/intended learning outcomes	General Chemistry Lab 1 is the experimental part accompanying the General Chemistry theory module. The purpose of the course is to help students practice using some basic tools and equipment in the laboratory, thereby verifying experimentally the theoretical concepts of general chemistry.
Content	Students are trained to know how to prepare for experiments, how to conduct experiments according to procedures, how to record data, and how to present results scientifically. In this module, students need to perform the following experiments:

	(1) Uses of equipment in the chemistry laboratory: How to use and record the data obtained. (2) Using a titration device, applicable to the titration of table vinegar (3) Acidic and basic properties of solutions (4) Determine the molar mass of a volatile liquid (5) Chemical Equilibrium Survey (6) Determination of thermodynamic parameters of Borax . dissolution process (7) Determine the order of the reaction (8) Determination of electrode potential
Examination forms	Lab reports
Study and examination requirements	Attend all the experiment hours
Reading list	[1] Võ Duy Thanh, Võ Văn Bé (2009). Giáo trình thực tập Hóa đại cương A. Tp HCM: ĐHQG Tp HCM. [2] Võ Duy Thanh, Võ Văn Bé (2009). Bài tường trình thực tập Hóa đại cương A. Tp HCM: ĐHQG Tp HCM.

19. General Physics 1 (Mechanics - Thermodynamics)

Module designation	**General Physics 1 (Mechanics - Thermodynamics)** , PHY00001
Semester(s) in which the module is taught	1st semester
Person responsible for the module	Dang Vinh Quang, PhD
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lectures, discussion
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 45 hour(s) Exercise: 22.5 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	6 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	This course covers the principles of kinematics, dynamics, statics, work, energy, linear momentum, gravitation, and thermodynamics. Students who complete this module could be achieved the following: - Students are 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. - Students are able to work at individual level and group work. - Students have the ability to apply mechanics and thermodynamics knowledge to analyse physical situations.
Content	Chapter 1:Physics and measurement (1hour) Chapter 2: Kinematics of particles (6 hours) Chapter 3: Force and Newton's laws (8 hours) Chapter 4: Conservation laws in classical mechanics (6 hours) Chapter 5: Kinetics of rigid bodies (8 hours) Chapter 6: The ideal gas (3 hours) Chapter 7: The first law of thermodynamics (7 hours) Chapter 8: The second law of thermodynamics (6 hours)
Examination forms	- Exercise: 20% - Attendance: 5% - Midterm test (essay): 25% - Final exam (essay): 50%
Study and examination requirements	The minimum attendance is about 80%, submit all exercises on time.
Reading list	1.Nguyen Nhat Khanh, 2005. Lectures on mechanics and heat. Ho Chi Minh City National University Publishing House. 2.Nguyen Thanh Van, 2013. General physics (Mechanics and heat). Ho Chi Minh City National University Publishing House

20. General Physics 2 (Electromagnetism - Optics)

Module designation	**General Physics 2 (Electromagnetism - Optics)** , PHY00002
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Nguyen Phuoc Trung Hoa
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	lecture, lesson, brainstorming
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 45 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	4.5 ECTS
Required and recommended prerequisites for joining the module	General Physics 1
Module objectives/intended learning outcomes	Students have basic knowledge of electric and magnetic fields, optical laws of light. Students apply the laws of interaction between charged particles and interactions between electric currents, basic laws of electric currents in electric circuits. Students explain and apply the phenomena of interference, diffraction and polarization of light.
Content	Chapter 1. Electrostatics 7 hours Chapter 2. Conductors 4 hours Chapter 3. Constant current 4 hours

	Chapter 4. Magnetostatics 7 hours Chapter 5. Electromagnetic induction 4 hours Chapter 6. Electromagnetic waves 4 hours Chapter 7. Interference of Light Waves 5 hours Chapter 8. Diffraction of Light Waves 5 hours Chapter 9. Polarization of Light Waves 5 hours
Examination forms	Homework: 20% Midterm exam: 30% Final exam: 50%
Study and examination requirements	Students are not allowed to be absent for more than 15 hours.
Reading list	1. Vật lý đại cương 2, Nguyễn Thành Vấn, NXB ĐHQG-HCM, 2015 2. Fundamentals of Physics, by David Halliday, Wiley, 2014

21. Labwork on General Physics

Module designation	**Labwork on General Physics,** PHYS10081
Semester(s) in which the module is taught	3th semester
Person responsible for the module	Faculty of Physics and Engineering Physics
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Discussion, Labwork, Q&A
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 0 hour(s) Exercise: 0 hour(s) Laboratory: 60 hour(s) Preparation and followup: 60 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 1 self-study hour 1 exercise (lab) hour = 1.0 self-study hour
Credit points	4 ECTS
Required and recommended prerequisites for joining the module	No
Module objectives/intended learning outcomes	This course is a practical subject in the laboratory. This course helps students understand how to measure some physical quantities, experimental errors, analyze and evaluate measurement results. Students who complete this module could be achieved the following: - Knowledge: Be able to describe the process, how to measure fundamental physical quantities in the laboratory. Be able to use instruments and equipment to measure experimental data of physical quantities correctly. Be able to determine (calculate) physical quantities from measured

	experimental data. Be able to determine the error of experimental measurement of physical quantities. - Skills: Be able to work in individual, group work, self-study, and problem solving. - Competences: Be able to analyze, process and write experimental data reports. - Attitude: be honest, responsible, respect for colleagues..
Content	Students practice 10 of the following 13 experiments: 1. Practice 1: Density of liquid and solids. The specific mass of the metals 2. Practice 2: Viscosity. Viscosity is dependence of different temperature 3. Practice 3: Reversible pendulum. The Mathematical pendulum 4. Practice 4: Heat of function for ice. Determination of heat 5. Practice 5: Mechanical equivalent of heat. The heat capacity of metals 6. Practice 6: Wheatstone Bridge. Resistor is dependence of different temperature 7. Practice 7: Voltmeter and Amperemeter DC. Voltmeter and Amperemeter AC 8. Practice 8: AC circuit. RLC circuit 9. Practice 9: Diode characteristics 10. Practice 10: Transistor characteristics 11. Practice 11: Microscope. To measure diameter of other small object 12. Practice 12: Refraction by a prism. Dispersion and resolving power of the prisms 13. Practice 13: Polarization of light Rotatory power
Examination forms	Oral presentation, essay, discussion, attendance.
Study and examination requirements	Assessment method: 1. Homework assignment (Practice report) = 20%

	2. Final test = 80%
Reading list	Main text books: Dang van Liet, Do Dinh Luyen, Nguyen Van Nghia, Tran Thi Kim Phuong, “General Physics Experiments”, University of Science, -VNUHCM, 2008

22. Academic and Professional Skills (updated)

Module designation	Academic and Professional Skills, MST10005
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	Pham Hai Lam, Tran Thi Thanh Van
Language	Vietnamese
Relation to curriculum	Elective course
Teaching methods	Discussion, Practice, Q&A
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	No
Module objectives/intended learning outcomes	Students completing this course will be equipped with the following foundational skills and knowledge essential for academic and professional success: - Goal Setting and Planning Understand how to define goals, prioritize objectives, manage tasks, and develop effective plans for study and work. - Communication Skills Learn key communication techniques applicable in both academic and professional environments, including verbal communication, non-verbal cues

	(body language), active listening, academic and professional writing, effective questioning, and constructive feedback. - Presentation Skills Master the process of effective presentations—from preparation and content development to delivery and handling unexpected situations confidently. - Teamwork Understand the dynamics of team-based work and develop skills for effective collaboration, role distribution, and conflict resolution within groups. - Problem Solving and Critical Thinking Apply a systematic approach to solving problems: identify and define the issue, gather and analyze information, propose multiple solutions, and make informed decisions. Critical thinking is emphasized throughout this process. - Professionalism Recognize the importance of professional behavior and attitudes in the workplace, helping students to perform effectively and build a strong foundation for career development.
Content	□ College study skills □ Teamwork Skills □ Problem solved Skills □ Time Management and Planning Skills □ Effective Communication Skills □ Conflict Resolution Skills □ Become Global Citizen Skills □ Creative Problem-Solving Skills
Examination forms	Oral presentation, Q&A, Quiz, Problem/Situation solving
Study and examination requirements	Total score greater than or equal to 5.

Reading list	[1] Tony Buzan, sách "How To Mind Map", NXB Thorsons, 2002 [2] Ecric Garner, sách "The Art of Communicating", NXB Ventus Publishing ApS, 2012 [3] Dale Carnegie, sách "How To Win Friends and Influence People", NXB Simon & Schuster, Inc, 1981 [4] Martha Davis, Patrick Fanning, Matthew McKay, sách "How To Communicate", NXB MJF Books, 2004 [5] Ellen Kaye, sách "Maximize Your Presentation Skills: How to Speak, Look, and Act on Your Way to the Top", NXB Prima, 2002

23. Modern Physics (Quantum - Atomic - Nuclear)

Module designation	**Modern Physics (Quantum - Atomic - Nuclear)** , PHY00004
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	Tran Duy Tap, PhD
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 30 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	5 ECTS
Required and recommended prerequisites for joining the module	General Physics 1, General Physics 2
Module objectives/intended learning outcomes	Upon completing the course, -Students have basic and foundational knowledge of modern physics related to quantum physics, atomic physics, and nuclear physics - students have scientific discussion skills in the classroom and critical thinking. - students will be able to connect, explain, or analyze various phenomena, principles, or experimental results of modern physics as applied to science and everyday life

Content	Chapter 1: Particle Properties of Light Lesson 1.1: Blackbody Radiation Lesson 1.2: Photoelectric Effect Lesson 1.3: Compton Scattering Chapter 2: Fundamentals of Quantum Mechanics Lesson 2.1: Wave-Particle Duality of Matter Lesson 2.2: Wavefunction Lesson 2.3: Heisenberg Uncertainty Principle Chapter 3: Schrödinger Equation Lesson 3.1: Schrödinger Equation Lesson 3.2: Particle in a One-Dimensional Potential Well Lesson 3.3: Potential Barrier - Tunneling Effect Lesson 3.4: Harmonic Oscillator Chapter 4: Atomic Physics Lesson 4.1: Atomic Models Lesson 4.2: Hydrogen Atom Lesson 4.3: Alkali Metal Atoms Lesson 4.4: Angular Momentum and Magnetic Moment of Electrons Lesson 4.5: Electron Spin Lesson 4.6: Mendeleev's Periodic Table Chapter 5: Nuclear Physics Lesson 5.1: Nuclear Properties and Characteristics Lesson 5.2: Binding Energy and Nuclear Forces Lesson 5.3: Nuclear Structure Models Lesson 5.4: Radioactive Decay Lesson 5.5: Nuclear Reactions and Applications
Examination forms	Homework: 20% Midterm exam: 30% Final exam: 50%

Study and examination requirements	The minimum attendance is about 80%, submit all exercises on time.
Reading list	1. Huỳnh Trúc Phương, Châu Văn Tạo, Trương Thị Hồng Loan, Lượng tử - Nguyên tử - Hạt nhân, ĐHQG-HCM, 2013 2. Lương Duyên Bình, Ngô Phú An, Lê Băng Sương, Nguyễn Hữu Tăng, Vật lý đại cương (Tập 3), NXB Giáo Dục, 2003

24. Fundamentals of Materials Science (updated)

Module designation	**Fundamentals of Materials Science** , MSC00001
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	Trần Thị Như Hoa
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	lecture, lesson
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 15 hour(s) Exercise: 30 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.5 ECTS
Required and recommended prerequisites for joining the module	General Chemistry 1; General Chemistry 2; General Physics 2
Module objectives/intended learning outcomes	+ Provide students with basic knowledge about atomic structure and types of bonds in solids, crystal structure of solids, defects in solids, phase diagrams of solids + Have the skills to self-study, search, exploit, process and apply information about knowledge related to the subject + Have the skills to work in groups.
Content	This subject provides knowledge related to the microstructure of materials, types of defects that exist in solids and the structure of multi-component materials. Have basic knowledge about the properties of materials such as:

	optical properties, electrical properties, magnetic properties... to be able to explain some phenomena in nature and know the potential applications of materials. Chapter 1: Introduction and Classification and Properties of Materials Chapter 2: Atomic Structure and Bondings Chapter 3: Crystalline Structure Chapter 4: Defects in Solid Materials Chapter 5: Diffusion in Materials Chapter 6: Selected Properties of Materials and Applications
Examination forms	Midterm Test Scores Regular Test Scores Final Exams
Study and examination requirements	● Minimum attendance for theory classes: 70% ● Minimum attendance for homework classes: 50% ● Minimum attendance for discussion classes: 20% ● Other requirements: Students submit complete assignments and look up lectures and materials at home according to
Reading list	1. Materials Science and Engineering: An Introduction by William D. Callister Jr., David G. Rethwisch (2010). ISBN 10: 0470419970 ISBN 13: 9780470419977. John Wiley & Sons. Inc 2. Engineering Materials: Properties and Selection by Kenneth G. Budinski (19

25. Practice of Fundamental Materials Science (new course)

Module designation	**Practice of Fundamental Materials Science**
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Assoc. Prof. Dr. Tran Thi Thanh Van Dr. Tran Thi Nhu Hoa Dr. Le Khac Top MSc. Huynh Nguyen Thanh Luan Assoc. Prof. Dr. Ha Thuc Chi Nhan
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Laboratory practice, group work, discussion, report writing
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Laboratory: 60 hours Self-study and report preparation: 40 hours
Credit points	4 ECTS
Required and recommended prerequisites for joining the module	General Chemistry Laboratory, Inorganic and Organic Chemistry, General Materials Science
Module objectives/intended learning outcomes	Upon successful completion of this module, students will be able to: **Knowledge** Identify and classify fundamental types of materials (metals, ceramics, polymers, composites) based on their structures and properties. Explain the relationship between atomic structure, microstructure, defects, and material properties through laboratory experiments. Understand the influence of external factors such as temperature, mechanical stress, and environment on the

	mechanical, thermal, electrical, and optical properties of materials. Recognize the role of diffusion and thermally activated processes in determining material behavior. **Skills** Prepare and analyze material samples using standard laboratory techniques (cutting, grinding, polishing, etching, microscopy). Perform basic experimental measurements of mechanical, thermal, electrical, and optical properties. Record, analyze, and interpret experimental results using tables, graphs, and scientific reporting. Apply problem-solving skills to connect experimental observations with theoretical concepts in materials science. Work effectively in teams, share responsibilities, and communicate experimental results through oral presentations and written reports. **Attitudes** Demonstrate honesty, responsibility, and professionalism in laboratory work. Follow laboratory safety rules, handle chemicals and instruments properly, and respect the working environment. Develop a critical and inquisitive attitude toward experimental results and their implications for materials design and applications.
Content	Lesson 1: Course Introduction and Laboratory Safety Regulations (week 1) Lesson 2: Practice on Structure and Microstructure of Materials (week 2-3) Lesson 3: Investigation of Mechanical Properties of Materials (week 4-5) Lesson 4: Investigation of Thermal Properties of Materials (week 6-7)

	Lesson 5: Investigation of the Effect of Defects on the Electrical Properties of Materials (week 8) Lesson 6: Investigation of the Optical Properties of Materials (week 9) Lesson 7: Investigation of the Effect of Temperature on Diffusion Processes (week 10)
Examination forms	· Continuous assessment (60%): ● Laboratory performance and attendance (10%) ● Laboratory reports (30%) ● Group discussions and presentations (20%) Final exam (40%): Written test covering all experiments and concepts.
Study and examination requirements	● Attend class 100% laboratory sessions are compulsory.). Total marks > 5.
Reading list	Lecture notes. + Handbook for Laboratory Safety, Sveinbjornsson, B. (Ed.). Academic Press, 2015. + William D. Callister, Materials Science and Engineering: An Introduction, 10th ed., John Wiley & Sons, 2018. + Kenneth G. Budinski, Engineering Materials: Properties and Selection, Prentice Hall, 1996. + Tran The San, General Materials Science (in Vietnamese), VNU-HCM Press, 2013.

26. Introduction to Materials Technology

Module designation	**Introduction to Materials Technology** , MST00003
Semester(s) in which the module is taught	1st semester
Person responsible for the module	Trần Thị Minh Thư, Đặng Vinh Quang, Trần Thị Như Hoa
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	lecture, lesson, seminar
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 15 hour(s) Exercise: 30 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	+ Provide students with basic concepts and core components of materials science and technology; introduce the training program + Have the skills to search, exploit, process and apply information about knowledge related to the subject + Have the skills to work in groups.
Content	The objective of the course is to introduce an overview, basic concepts and core components of materials science and technology, introduce the training program, from issues: structure, properties, manufacturing, testing, evaluation and

	use of materials to their relationships to emphasize the diversity, multi-principles of materials science and technology, the importance and significance of applications in life, create a favorable environment for students to learn and experience, practice skills, raise awareness of learning responsibility, professional responsibility and participate in community activities.
Examination forms	Regular Test Score Discussion Score Group Report Score End of Term Exam
Study and examination requirements	• Minimum attendance in theory classes: 90% of the number of lectures • Minimum attendance in discussion classes: 90% of the number of lectures • Other requirements: Students must strictly comply with the rules and regulations of the Faculty and the Schoo
Reading list	1. Materials Science and Engineering: An Introduction by William D. Callister Jr., David G. Rethwisch (2013). ISBN 10: 0470419970 ISBN 13: 9780470419977. John Wiley & Sons. Inc 2. Vật liệu Đại cương, Trần Thế San (2013). NXB Đại học Quốc gia TP.HCM

27. **Basic Informatics**

Module designation	**Basic Informatics** , CSC00003
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	HCMUS Computer center (www.csc.edu.vn)
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, practice on computer, learn through video
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 15 hour(s) Exercise: 0 hour(s) Laboratory: 60 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	5.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- Students have the general knowledge of computers as well as the fundamentals of working with the Windows operating system and Internet services. The course also helps to equip students with the knowledge and skills to: - Students have the ability to working with common software on computers - Students have the ability to prepare text. presentation and data calculation with calculators - Students can build electronic information pages.

Content	Part 1. Basic IT knowledge - Basic knowledge of computers and computer networks - Control access, ensure data safety - Malware (malware) - Some basic legal issues in using IT Part 2. Basic computer use - Microsoft Word - Basic Microsoft Powerpoint - Microsoft Excel - Using the Internet - Web image processing - Design a website with HTML & CSS3
Examination forms	- Attendance: 10% - Regular exercise: 10% - Midterm test (practice on computer): 30% - Final exam (multiple choice): 50%
Study and examination requirements	- The minimum attendance of lectures is about 80%; - Full attendance in practical, on time.
Reading list	1. Microsoft Office MOS Document. IIG Vietnam. 2. IC3 Spark Document. IIG Vietnam.

28. English 1

Module designation	**English 1** , ADD00031
Semester(s) in which the module is taught	1st semester
Person responsible for the module	Center for foreign languages - HCMCUS
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Presentations, debates, role-plays, assignments, tests
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 30 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	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 vocabulary and grammar in four skills: Listening, Speaking, Reading and Writing. Here are the objectives in detail: - Students can 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; understand and use grammar structures at the pre-intermediate level such as basic tenses and other related matters.

	- Students have the ability to choose the answer that best describes the given picture, choose the correct response to the questions, and understand dialogues and short monologues. - Students have the ability to pronounce single words, word clusters and sentences, describe a given picture, and build basic communications in daily life. - Students have the ability to comprehend 300-500 word passages of familiar topics, and gain more knowledge of different cultures around the world - Students have the ability to write essays about familiar topics related to daily life, learning activities, entertainment, events.
Content	Module 1: Leisure and lifestyle (6 hours) Module 2: Important firsts (6 hours) Module 3: At rest, at work(6 hours) Module 4: Special occasions(6 hours) Module 5: Appearance (6 hours) Module 6: Time off (6 hours) Module 7: Ambitious dreams (6 hours) Module 8: Countries and cultures (6 hours) Review - speaking test (12 hours)
Examination forms	- Attendance: 10% - Regular exercise: 10% - Mid-term test (multiple choice): 30% - Final exam (speaking test + multiple choice): 50%
Study and examination requirements	The minimum attendance of lectures is about 80%;
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: Pearso

29. English 2

Module designation	**English 2** , ADD00032
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Center for foreign languages - HCMCUS
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Presentations, debates, role-plays, assignments, tests
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 30 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	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 vocabulary and grammar in four skills: Listening, Speaking, Reading and Writing. Here are the objectives in detail: - Students can 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; 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. - Students have the ability to choose the correct response for the questions, and understand dialogues and short monologues. - Students have the ability 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. - Students have the ability to comprehend 500-700 word passages of familiar topics, and gain more knowledge of different cultures around the world. - Students have the ability to write appropriate responses to written requests or complaints in business and social contexts, applying theories into real life practice.
Content	Module 1: Old and new (8 hours) Module 2: Take care! (8 hours)) Module 3: The best thing in life (8 hours) Module 4: Got to have it! (8 hours) Module 5: Choosing the right person (8 hours) Module 6: Money, Money, Money (8 hours) Module 7: Imagine (8 hours) Review (4 hours)
Examination forms	- Attendance: 10% - Regular exercise: 10% - Mid-term test (multiple choice): 30% - Final exam (speaking test + multiple choice): 50%
Study and examination requirements	The minimum attendance of lectures is about 80%;
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: Pearso

30. **English 3**

Module designation	**English 3** , ADD00033
Semester(s) in which the module is taught	3rd semester
Person responsible for the module	Center for foreign languages - HCMCUS
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Presentations, debates, role-plays, assignments, tests
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 30 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	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 vocabulary and grammar in four skills: Listening, Speaking, Reading and Writing. Here are the objectives in detail: - Students can 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. - Students can understand and use new language in a natural, communicative way.

	- Students have the ability to present their opinions about some social and cultural issues and understand dialogues and talks. - Students have the ability to comprehend 500-700 word passages of familiar topics, and gain more knowledge of different cultures around the world. - Students have the ability to write paragraphs about familiar topics related to daily life, learning activities, entertainment, events, etc
Content	Module 1: All about you (8 hours) Module 2: Memory (8 hours) Module 3: Around the world (8 hours) Module 4: Life stories (8 hours) Review module 1 to 4, practice speaking (8 hours) Module 5: Success (8 hours) Module 6: In the media (8 hours) Review (4 hours)
Examination forms	- Attendance: 10% - Regular exercise: 10% - Mid-term test (multiple choice): 30% - Final exam (speaking test + multiple choice): 50%
Study and examination requirements	The minimum attendance of lectures is about 80%;
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: Pearso

31. English 4

Module designation	**English 4** , ADD00034
Semester(s) in which the module is taught	4th semester
Person responsible for the module	Center for foreign languages - HCMCUS
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Presentations, debates, role-plays, assignments, tests
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 30 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	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 vocabulary and grammar in four skills: Listening, Speaking, Reading and Writing. Here are the objectives in detail: - Students have the ability to understand and use the language needed in more complex real-life situations in a natural, communicative way - Students have the ability to express their own ideas in interviews, mini-talks, problem-solving and storytelling

	- Students have the ability to comprehend 700-1000 word passages of up-to-date topics of international interest, and learn more about the world and other cultures - Students have the ability to write essays about familiar topics related to daily life, learning activities, entertainment, events, etc.
Content	Module 1: Socialising (8 hours) Module 2: Things you can't live without (8 hours) Module 3: Future society (8 hours) Module 4: An amazing story (8 hours) Review module 1 to 4, practice speaking (8 hours) Module 5: Rules and freedom (8 hours) Module 6: Dilemmas (8 hours) Revision of grammar (4 hours)
Examination forms	- Attendance: 10% - Regular exercise: 10% - Mid-term test (multiple choice): 30% - Final exam (speaking test + multiple choice): 50%
Study and examination requirements	The minimum attendance of lectures is about 80%;
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: Pearso

32. Thermodynamics of Materials (updated)

Module designation	**Thermodynamic of Materials,** MST10023
Semester(s) in which the module is taught	4th semester
Person responsible for the module	Prof Le Van Hieu, Dr Tran Thi Minh Thu
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	lecture, lesson
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Private study including examination preparation, specified in hours[1]: 60
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	General Chemistry, General Physics
Module objectives/intended learning outcomes	Knowledge: general understanding of the principles of thermodynamics, thermodynamic equilibrium states and colloidal chemistry Skills: cognitive and practical abilities for which knowledge is used Competences: integration of knowledge, skills and social and methodological capacities in working or learning situations
Content	Chapter 1: Principles of thermodynamics Chapter 2: Phase diagram Chapter 3: Colloidal chemistry

[1] When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.

Examination forms	Exercises : 40% Final exam (essay) : 60%
Study and examination requirements	Attendance at least 80% Total mark >=5
Reading list	1. Thermodynamics in materials science, Dehoff Robert T., McGraw-Hill , 1993. 2. Physical chemistry, Noggle Joseph H., Harper Collins, 1996. 3. Physical chemistry, Atkins Peter , Paula Julio de, W.H. Freeman and Company, 2002. 4. Giáo trình hóa lí : tập I : cơ sở nhiệt động lực học, Nguyễn Đình Huề, Giáo dục Việt Nam , 2009. 5. Giáo trình hóa lí : tập II : nhiệt động lực học hóa học Smith N.O, Nguyễn Đình Huề, Giáo dục Việt Nam , 2009.

33. Physical Education 1

Module designation	**Physical Education 1** , BAA00021
Semester(s) in which the module is taught	1st semester
Person responsible for the module	Sports Center, Vietnam National University-HCM
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Method of explanation and modeling Method of completion and division Training method: repetition, change of content, game, competition.... Method of correcting wrong movements.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 15 hour(s) Exercise: 0 hour(s) Laboratory: 30 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- Understanding the effects of physical training on children's health people and the role of physical education in the goal of comprehensive education - Having knowledge about injury prevention and birth in sports training and competition. Knowledge of types of physical exercises to improve health and develop physical

	fitness groups in accordance with the development of the organism: knowledge of planning and regular exercise method. - Knowledge of development history, rules, organization of competition and refereeing number of sports learned. Mastering technical principles, tactics, contents, methods and forms of organizing sports practice in the training program. - Practice regularly to improve health, develop physical fitness groups, and participate in sports competitions in the training program. Have skills to practice basic techniques and apply strategies.
Content	Choose from one of the subjects: ● Football 1 ● Volleyball 1 ● Basketball 1 ● Table tennis 1 ● Tennis 1 ● Badminton 1 ● Martial Arts 1 ● Aerobic 1 ● Swimming 1 ● Chess 1
Examination forms	- Subject scores are based on a student's overall academic performance throughout their studies, including component scores: Attendance (CC), Mid-term test (KTGK), End-of-course exam (KTMH) - Subject score (100%)=CC score(10%)+ KTGK score(30%)+ KTMH test
Study and examination requirements	Students will be recognized to have completed the University-level Physical Education Subject Program and be granted a Physical Education Certificate according to current

	regulations when having a subject score of 5 or more points in 02 subjects. semester
Reading list	1. Luu Quang Hiep, Le Duc Chuong, Vu Chung Thuy, Le Huu Hung (2000), Sports Medicine, Sports Publishing House, Hanoi. 2. Nguyen Toan, Pham Danh Ton (2000), Theory and methods of physical training and sports, Sports Publishing House, Hanoi.

34. Physical Education 2

Module designation	**Physical Education 2** , BAA00022
Semester(s) in which the module is taught	2nd semester
Person responsible for the module	Nguyen Van Ba
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Method of explanation and modeling Method of completion and division Training method: repetition, change of content, game, competition.... Method of correcting wrong movements.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 15 hour(s) Exercise: 0 hour(s) Laboratory: 30 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	- Understanding the effects of physical training on children's health people and the role of physical education in the goal of comprehensive education. - Having knowledge about injury prevention and birth in sports training and competition. Knowledge of types of physical exercises to improve health and develop physical

	fitness groups in accordance with the development of the organism: knowledge of planning and regular exercise method. - Knowledge of development history, rules, organization of competition and refereeing number of sports learned. Mastering technical principles, tactics, contents, methods and forms of organizing sports practice in the training program. - Practice regularly to improve health, develop physical fitness groups, and participate in sports competitions in the training program. Have skills to practice basic techniques and apply strategies
Content	Student will choose one of subjects: ● Football 2 ● Volleyball 2 ● Basketball 2 ● Table tennis 2 ● Tennis 2 ● Badminton 2 ● Martial Arts 2 ● Aerobic 2 ● Swimming 2 ● Chess 2
Examination forms	- Subject scores are based on a student's overall academic performance throughout their studies, including component scores: Attendance (CC), Mid-term test (KTGK), End-of-course exam (KTMH) - Subject score (100%)=CC score(10%)+ KTGK score(30%)+ KTMH test
Study and examination requirements	Students will be recognized to have completed the University-level Physical Education Subject Program and be granted a Physical Education Certificate according to current

	regulations when having a subject score of 5 or more points in 02 subjects. semester
Reading list	1. Luu Quang Hiep, Le Duc Chuong, Vu Chung Thuy, Le Huu Hung (2000), Sports Medicine, Sports Publishing House, Hanoi. 2. Nguyen Toan, Pham Danh Ton (2000), Theory and methods of physical training and sports, Sports Publishing House, Hanoi.

35. National Defense Education

Module designation	**National Defense Education** , BAA00030
Semester(s) in which the module is taught	1st semester
Person responsible for the module	The Center for Defense and Security Education
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, lab works
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: hour(s) Exercise: hour(s) Laboratory: hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	8 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Knowledge: After completing the national defense and security education program, students will have a basic understanding of the Party and State's defense and security policies and guidelines on building national defence nationwide and security, love socialism. Grasp basic knowledge about national defense and security in the new situation. Proficient in commanding the team of each person with a gun, knowing the team of the unit; have a general understanding of the military branches in the

	Vietnamese people's army; have initial understanding of military maps; Know how to prevent enemy fire attacks with high-tech weapons. Skills: Able to practice basic skills in infantry combat techniques, individual tactics in combat, attack, defense, and guard duty, know how to use AK submachine guns and grenades.
Content	Module I: National defense and security policy of the Communist Party of Vietnam 1. Subjects, tasks, research methods of the subject 2. Basic views of Marxism-Leninism, Ho Chi Minh's ideology on war, army and national defense 3. Building national defense and people's security to protect the socialist Vietnamese nation. 4. People's War to protect the Socialist Fatherland of Vietnam 5. Building the people's armed forces 6. Combine economic and social development with strengthening national defense, security, and foreign affairs. 7. Basic issues about the history of Vietnamese military art 8. Building and protecting sovereignty over seas, islands, and national borders in the new situation 9. Building militia and self-defense forces, reserve forces and national defense mobilization 10. Building a movement of all people to protect national security. 11. Basic issues of protecting national security and ensuring social order and safety Module II: National defense and security work 1. Preventing and combating the strategy of "peaceful evolution", riots and overthrow by forces hostile to the Vietnamese revolution. 2. Some basic contents about ethnicity, religion, fighting against hostile forces taking advantage of ethnic and religious issues to sabotage the Vietnamese revolution.

	3. Preventing and combating of violations of laws on environmental protection. 4. Preventing and combating violations of laws on ensuring traffic order and safety. 5. Preventing and combating certain types of crimes that harm the honor and dignity of others. 6. Information security and prevention and combat of law violations in cyberspace. 7. Non-traditional security and non-traditional security threats in Vietnam Module III: General Military 1. Living, studying, and working regime during the day and week 2. Regular order regimes, internal order arrangements in the barracks 3. General understanding of troops and branches in the army. 4. Order the team of each person with a gun. 5. Unit team command. 6. General understanding of military topographic maps. 7. Prevent enemy fire attacks with high-tech weapons. 8. Three military disciplines coordinate Module IV: Infantry combat techniques and tactics 1. AK24 submachine gun shooting techniques. 2. Features, structure, and usage of some commonly used grenades. Throw grenades. 3. Each person in battle attacks 4. Each person in defensive combat 5. Each person is responsible for guarding (vigilance)
Examination forms	Essay, Practicing test
Study and examination requirements	- Students study directly at the Center for Defense and Security Education (hereinafter referred to as the Center). Students must stay 100% in the Center's dormitory during the

	prescribed study period and are not allowed to leave at the end of the day, in
Reading list	1. National Defense and Security Education Curriculum (Volume 1) 2. National Defense and Security Education Curriculum (Volume 2)

36. Materials Chemistry (new course)

Module designation	**Materials Chemistry**
Semester(s) in which the module is taught	4th semester
Person responsible for the module	Le Ngoc Ha Thu; Tran Cong Khanh
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, Discussion
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 30 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	5 ECTS
Required and recommended prerequisites for joining the module	General Chemistry 1, General Chemistry 2
Module objectives/intended learning outcomes	Upon successful completion of this course, students will be able to: 1. Explain fundamental concepts of inorganic and organic chemistry relevant to materials science, including bonding, acid–base, redox, and major functional groups. 2. Describe how these chemical principles determine the structure, properties, and applications of key materials such as oxides, ceramics, glass, alloys, polymers, and nanomaterials.

	3. Apply knowledge of inorganic and organic compounds to analyze and discuss the role of chemistry in the design and fabrication of advanced materials. 4. Perform basic laboratory techniques for synthesizing, purifying, and characterizing representative inorganic and organic compounds. 5. Develop interdisciplinary thinking and experimental skills as a foundation for advanced courses in polymeric, biomedical, and hybrid materials.
Content	- The course provides fundamental knowledge of inorganic chemistry related to materials, focusing on bonding, acid–base reactions, redox processes, the chemistry of elements, and coordination compounds. The content is linked to important classes of inorganic materials such as oxides, ceramics, glass, solid-state compounds, alloys, and nanomaterials. The practical component familiarizes students with basic methods for synthesizing and characterizing inorganic materials. - The course also offers foundational knowledge of organic chemistry concerning the structure, properties, and characteristic reactions of major classes of organic compounds, including hydrocarbons, alcohols, phenols, aldehydes, ketones, carboxylic acids, esters, and amines. The content emphasizes fundamental reaction mechanisms (addition, substitution, elimination, and polymerization) and their direct connection to materials science, particularly polymers, biomaterials, and hybrid organic–inorganic materials. The organic chemistry laboratory provides students with essential skills in identifying functional groups and synthesizing selected simple organic compounds.
Examination forms	Paper tests with free response questions; mini-tests and essay
Study and examination requirements	Minimum class attendance: 70% of class sessions, Total score greater than or equal to 5.
Reading list	1. Nguyễn Thị Tố Nga, Inorganic Chemistry, Ho Chi Minh City National University Publishing House, 2002

	2. Bradley D. Fahlman, *Materials Chemistry,* Springer, 2011 3. Lê Ngọc Thạch, Đoàn Ngọc Nhuận, Lưu Thị Xuân Thi, Nguyễn Thị Thảo Trân, Trần Hoàng Phương, Đoàn Lê Hoàng Tân, Hóa học Hữu cơ Tập 1, 2 và 3, NXB Đại học Quốc gia Tp. Hồ Chí Minh, 2018; 4. John McMurry, Organic Chemistry, 9th Edition; Belmont, CA, Thomson Brooks/Cole

37. Methods for Fabricating Inorganic Materials

Module designation	**Methods for Fabricating Inorganic Materials** , MST10029
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Nguyen Phuoc Trung Hoa, PhD
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	lecture, lesson
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	+ Provide students with basic knowledge of the theoretical foundations of inorganic material synthesis methods + Have the skills to search, exploit, process and apply information about knowledge related to the subject + Have the skills to work and interact with teachers
Content	This course equips students with basic knowledge of the theoretical foundations of inorganic materials synthesis methods, especially low-dimensional inorganic materials (thin films, nanorods, nanofibers, nanotubes, nanoparticles).

	Students will apply the above theoretical foundations to the experimental course of material synthesis. Introduction to synthesis of inorganic materials Synthesis of thin film CVD Synthesis of nanoparticles Micro-emulsion method Group report
Examination forms	Regular Test Scores End of Semester Exams
Study and examination requirements	• Minimum attendance for theory classes: 70% • Minimum attendance for practical classes: 90% • Minimum attendance for exercises: 50% • Minimum attendance for discussion classes: 70%
Reading list	1. Inorganic materials synthesis and fabrication, John N. Lalena, David A. Cleary, Everett E. Carpenter, Nancy F. Dean (2008). John Wiley&Sons 2. Vật liệu Kỹ thuật, Nguyễn Khắc Xương (2016). NXB Bách Khoa Hà Nội 3. Giáo trình vật liệu nano, Nguyễn Đại Hải

38. Properties Characterization Techniques of Materials

Module designation	**Properties Characterization Techniques of Materials**, MST10018
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Assoc. Prof. Dr. Tran Thi Thanh Van, Dr. Tu Thi Tram Anh, Dr. Ta Thi Kieu Hanh
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture; Group project presentations by students
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	Introduction to Materials Science
Module objectives/intended learning outcomes	General objective: This course provide students with fundamental knowledge of the physical principles and applications of several important material analysis methods, such as diffraction techniques, electron microscopy, scanning probe microscopy, Raman spectroscopy, and IR spectroscopy. This foundation will help students more easily select appropriate analytical methods for their research objectives.
Content	Chapter 1: Introduction

	Chapter 2: X-Ray Diffraction Chapter 3: Spectroscopic Methods Chapter 4: Electrical Property Analysis Chapter 5: Magnetic Property Analysis
Examination forms	Seminar, Group project, Essay
Study and examination requirements	Total score greater than or equal to 5.
Reading list	Kỹ thuật phân tích vật liệu, Lê Vũ Tuấn Hùng, NXB ĐHQG Tp.HCM, 2013. Physical Methods for Materials Characterization, P.E.J Flewitt, R.K. Wild, Institute of Physics Publishing, 1994. Materials characterization: Introduction to Microscopic and Spectroscopic Methods, Yang Leng, John Wiley & Sons, 2008.

39. Methods for Fabricating Organic Materials

Module designation	**Methods for Fabricating Organic Materials** , MST10016
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Đỗ Thị Vi Vi
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	lecture
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	Organic Chemistry, Polymer and composite materials
Module objectives/intended learning outcomes	This course provides knowledge of techniques and methods of polymer synthesis
Content	This course equips students with knowledge of polymer synthesis techniques and methods, including chain polymerization and step-growth polymerization. Upon completion, students will be able to access, understand, and conduct basic research on the synthesis of organic polymer materials..
Examination forms	essay

Study and examination requirements	Final exam ≥ 5
Reading list	1. Polymer synthesis, Kowsari E., Nomura Kotohiro , Baca Svetlana G., Ward Michael D., Nova Science (2012). 2. Handbook of ring-opening polymerization, Dubois Philippe, Coulembier Olivier, Raquez Jean-Marie, Wiley-VCH Verlag GmbH & Co (2009).

40. Practical Training in Material Fabrication Methods

Module designation	**Practical Training in Material Fabrication Methods** , MST10031
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Ta Thi Kieu Hanh, PhD
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Labwork
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 0 hour(s) Exercise: 0 hour(s) Laboratory: 45 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	Materials Synthesis Methods 1 and 2
Module objectives/intended learning outcomes	Apply knowledge of material fabrication methods effectively. Apply knowledge of material analysis techniques proficiently. Demonstrate proficiency in operating material fabrication equipment and material analysis instruments. Utilize data processing tools and software effectively. Work independently and contribute to teamwork efficiently.

	Exhibit responsibility in adhering to laboratory safety regulations and protocols.
Content	Lesson 1: Fabrication of Bulk SiO_2 Materials Lesson 2: Fabrication of ZnO Thin Films Using the Sol-Gel Method Lesson 3: Investigation of Curing Agent Content in Thermosetting Epoxy Resins and Mechanical Properties of Natural Fiber-Reinforced Composites Lesson 4: Synthesis of Magnetic Fe_3O_4 Nanoparticles Lesson 5: Practical Analysis of Material Properties: XRD, FTIR, UV-VIS, etc.
Examination forms	Report
Study and examination requirements	Attend all the labwork
Reading list	1. Tạ Thị Kiều Hạnh, Nguyễn Đức Hảo, La Phan Phương Hạ, Vũ Tiến Trung, Phạm Huy Lâm. Tài liệu các phương pháp chế tạo vật liệu. 2. Wang Xuanze. 2020. Preparation, Synthesis, and Application of Sol-Gel Method.

41. Methods for Structural and Morphological Analysis of Materials

Module designation	**Methods for Structural and Morphological Analysis of Materials** , MST10017
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Ta Thi Kieu Hanh, Cao Thi My Dung, Nguyen Thai Ngoc Uyen
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	lecture, seminar
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Knowledge: Students know how to use the basic knowledge about some methods of analyzing material structure and morphology of materials. Skills: Students have skills in using a number of software to process results and calculate data related to the structure and morphology of materials.
Content	General introduction to the module (3 hours) Chapter1: X-ray diffraction (6 hours)

	Chapter 2: Analysis technique using electron microscope (12 hours) Chapter 3: X-ray photoelectron spectroscopy (3 hours) Chapter 4: Software usage instructions (6 hours) Chapter 5: Infrared Spectroscopy (3 hours) Chapter 6: Nuclear Magnetic Resonance (3 hours)
Examination forms	Discussion: 10% Presentation: 20% Practice using the software: 10% Diligence: 10% Final exam: 50%
Study and examination requirements	Minimum attendance of lecture is about 80% Complete all required exercises and actively contribute to the construction of the lesson
Reading list	1. X-ray diffraction (XRD) techniques for materials characterization, Materials Characterization Using Nondestructive Evaluation (NDE) Methods, (2016) Elsevier Publish house 2. Introduction to Microscopic and Spectroscopic Methods, (2008) John Wiley & Son

42. Practical Training in Material Analysis Methods

Module designation	**Practical Training in Material Analysis Methods** , MST10032
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Ta Thi Kieu Hanh, PhD
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Labwork
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 0 hour(s) Exercise: 0 hour(s) Laboratory: 45 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	Materials Synthesis Methods 1 and 2
Module objectives/intended learning outcomes	Apply knowledge of material fabrication methods effectively. Apply knowledge of material analysis techniques proficiently. Demonstrate proficiency in operating material fabrication equipment and material analysis instruments. Utilize data processing tools and software effectively. Work independently and contribute to teamwork efficiently.

	Exhibit responsibility in adhering to laboratory safety regulations and protocols.
Content	Lesson 1: Fabrication of Bulk SiO_2 Materials Lesson 2: Fabrication of ZnO Thin Films Using the Sol-Gel Method Lesson 3: Investigation of Curing Agent Content in Thermosetting Epoxy Resins and Mechanical Properties of Natural Fiber-Reinforced Composites Lesson 4: Synthesis of Magnetic Fe_3O_4 Nanoparticles Lesson 5: Practical Analysis of Material Properties: XRD, FTIR, UV-VIS, etc.
Examination forms	Report
Study and examination requirements	Attend all the labwork
Reading list	1. Tạ Thị Kiều Hạnh, Nguyễn Đức Hảo, La Phan Phương Hạ, Vũ Tiến Trung, Phạm Huy Lâm. Tài liệu các phương pháp chế tạo vật liệu. 2. Wang Xuanze. 2020. Preparation, Synthesis, and Application of Sol-Gel Method. 3. Geoff Eckold, McGraw-Hill Inc., Design and

43. Laboratory Practices in Biological Techniques for Materials Science (updated)

Module designation	**Laboratory Practices in Biological Techniques for Materials Science,** MST10019
Semester(s) in which the module is taught	5th semester
Person responsible for the module	PhD. Tu Thi Tram Anh, Ha Van Linh, Msc
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Labwork
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 0 hour(s) Exercise: 0 hour(s) Laboratory: 60 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	4 ECTS
Required and recommended prerequisites for joining the module	Biology techniques
Module objectives/intended learning outcomes	Module objectives: This module provides laboratory practices that enable students to proficiently operate biological laboratory equipment; perform animal cell culture techniques; extract and characterize nucleic acids, proteins, and microorganisms; while developing fundamental biological skills applied to materials science, thereby preparing them for advanced modules such as Evaluation of Biological Properties of Materials and Laboratory Practice in Evaluation of Biological Properties of Materials. **ntended Learning Outcomes (ILOs)**

	Knowledge • Operate laboratory equipment and establish sterile environments in biological–materials research. • Prepare culture media for animal cells and relate it to experiments involving biomaterials. • Plan subculture schedules based on cell conditions and the need to observe adhesion on material surfaces. • Calculate DNA concentration from absorbance values and link results to the DNA-loading capacity of materials. • Determine DNA purity and estimate molecular weight using agarose gel electrophoresis in the context of DNA–material interactions. **Skills** • Thaw, culture, count, and cryopreserve animal cells, including observation of cell adhesion on material surfaces. • Extract DNA from animal cells using the phenol–chloroform method and apply results to biomaterials studies. • Operate agarose gel electrophoresis systems to analyze DNA/oligonucleotides bound to materials. • Stain and document electrophoresis gels to evaluate DNA behavior in material-related experiments. • Prepare nutrient media for bacterial culture to investigate the antimicrobial effects of materials. • Perform bacterial inoculation into liquid and solid media, and evaluate growth in the presence of materials. • Preserve bacterial strains using slant cultures and glycerol stocks for use in material-related microbiological studies. **Attitudes / Professional Responsibility**

	• Comply with biosafety and aseptic principles in biological laboratories, particularly when handling material samples.
Content	**Module Content – Summary** **Part 1. Animal Cell Culture Techniques** • **Week 1**: Laboratory equipment, sterilization, and use of microscope • **Week 2**: Preparation of culture media and thawing of animal cells • **Week 3**: Monitoring cell growth on material-coated plates, cell counting, and subculture • **Week 4**: Continuation of cell growth monitoring and cryopreservation of cells **Part 2. Molecular Biology Techniques** • **Week 5**: DNA extraction from animal cells and quantification by UV absorbance • **Week 6**: DNA size determination using agarose gel electrophoresis **Part 3. Microbiological Techniques** • **Week 7**: Preparation of nutrient media for bacterial culture • **Week 8**: Isolation of single bacterial colonies • **Week 9**: Preservation of bacterial strains using slants and glycerol stocks
Examination forms	lab work practical assessment, attendance, procedure assessment.
Study and examination requirements	Attend class (100% contact hours). Final examination > 5 points (5/10).
Reading list	A.S. Karwa, M.K. Rai & H.B. Singh.Handbook of techniques in microbiology - a laboratory guide to microbes. Scientific Publishers, 2021.

	Akash Gautam. DNA and RNA Isolation Techniques for Non-Experts. Springer Nature, 2022

44. Biotechnology (updated)

Module designation	**Biotechnology** , MST10021
Semester(s) in which the module is taught	5th semester
Person responsible for the module	Ha Van Linh, Msc; PhD. Tu Thi Tram Anh, Tran Quang Minh, Msc
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, Lab work
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Students are trained in the concepts and principles of the body's response to an implanted material is affected by a number of different factors. This comprehensive mastery ensures they are equipped with the knowledge and skills to apply techniques in the study of cell structure, genetic regulation, motility, and communication signaling behavior. Tests that may be used in the assessment of medical device biocompatibility include procedures for cytotoxicity, sensitization, irritation, acute systemic toxicity, subchronic toxicity, mutagenicity, genotoxicity, hemocompatibility etc.

	The course also provides skills to perform aseptic analyses and gene manipulation.
Content	Chapter 1. Biological testing techniques 1.1 Probe and labeling technologies 1.2 Examination of gene expression 1.3 The plasma membrane 1.4 Cytoskeleton and motility 1.5 Communication between cells 1.6 Mapping intracellular signaling Chapter 2. Cell–biomaterial interactions testing 2.1 Immunostaining techniques for studying cell–ECM interactions 2.2 Profiling a cell line for its ECM binding characteristics 2.3 Immunoprecipitation and Western blotting Chapter 3. Biocompatibility Testing 3.1 Introduction and Sample Preparation 3.2 Mammalian Cell Culture 3.3 Cytotoxicity Testing. 3.4 Hemocompatibility 3.5 Hypersensitivity/Allergic Responses Genotoxicity 3.6 Tissue Specific Aspects of Biocompatibility Testing 3.7 Animal Experimentation 3.8 Alternatives to Animal Experimentation
Examination forms	Mid-term Examination, Seminar and Final examination. Lab work practical assessment, attendance, procedure assessment.
Study and examination requirements	Attend class (>50% contact hours). Complete task performance (Seminar). Mid-term examination > 3 points (3/10) and Final examination > 4 points (4/10).
Reading list	1. Roger Narayan, 2009. Biomedical Materials. Springer Science+Business Media.

	2. C. Mauli Agrawal, Joo L. Ong, Mark R. Appleford, Gopinath Mani, 2014. Introduction to Biomaterials, Cambridge University Press.

45. Fundamentals of Manufacturing Materials, Processes & Systems (new course)

Module designation	**Manufacturing Technology: Materials, Progress and System**, MST000xx
Semester(s) in which the module is taught	4th semester
Person responsible for the module	PhD. Ha Thuc Chi Nhan, PhD Nguyen Phuoc Trung Hoa
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 15 hour(s) Exercise: 0 hour(s) Laboratory: 30 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 0.5 self-study hour
Credit points	3.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Upon successful completion of this module, students will be able to Explain the principles behind key manufacturing processes like casting, forming, machining, and joining. Analyze a simple production line as a system, identifying inputs, processes, and outputs. Discuss the impact of modern technologies, such as automation and 3D printing, on manufacturing.

	Evaluate the efficiency and potential for improvement in a given manufacturing scenario.
Content	Introduction to materials manufacturing Casting and Molding Forming and Shaping Machining Joining and Assembly Painting, polishing, and coating Additive Manufacturing (3D Printing) Progress and Innovation in Manufacturing
Examination forms	Group Project (40%): Analyze the manufacturing process and system of a product of your choice Final Exam (60%): Written exam covering all topics from the module
Study and examination requirements	Attend class (>50% contact hours). Total marks > 5.
Reading list	Lecture notes. Groover, Mikell P., Fundamentals of Modern Manufacturing: Materials, Processes, and Systems. 7th ed., Wiley, 2020.

46. Foundations of Solid-State Science

Module designation	**Foundations of Solid-State Science** , MST10022
Semester(s) in which the module is taught	4th semester
Person responsible for the module	Vu Hoang Nam
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	Modern Physics, General Materials Science, General Chemistry 1
Module objectives/intended learning outcomes	The course will provide a valuable introduction and an overview of the fundamental applications of the physics of solids. This course includes the description of crystal and electronic structure, lattice dynamics, and optical properties of different materials (metals, semiconductors, and dielectrics), based on the classical and quantum physics principles. After completing this course the students should be able to: 1. Establish an understanding of the different types of binding in solids having different structural symmetries

	2. Determine the structure of crystalline materials by x-ray diffraction 3. Establish an understanding of the impact of lattice vibrational modes on the heat capacity and heat transport of crystalline solids 4. Describe the band theory in for electrons in periodic potentials of crystal and apply it to describe electron dynamics in metals, semiconductors, and insulatiors 5. Understand the optical properties of crystal, which serve as a basis for analyzing the electronic structure and defects within the crystal.
Content	1. Crystal structures of solid matter (3 hours) 2. Diffraction from periodic structures (3 hours) 3. Dynamics of atoms in crystals (6 hours) 4. Electronic band structure of crystal solids (6 hours) 5. Electronic properties of semiconductors (6 hours) 6. Optical properties of crystal (6 hours)
Examination forms	Assessment, Discussion, Write exam
Study and examination requirements	50 %
Reading list	1. Nguyễn Thế Khôi, Giáo trình vật lý chất rắn, NXB ĐH Sư Phạm, 2024 2. Lê Khắc Bình, Nguyễn Nhật Khanh, Vật lý chất rắn, NXB ĐHQG Tp.HCM, 2002 3. C. Kittel, Introduction to Solid State Physics, J. Wiley and Sons, 8th Edition

47. Ceramic Materials (updated)

Module designation	**Ceramic Materials** , MST10025
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Nguyen Duc Hao, Msc; Tran Thi Thanh Van, PhD
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, seminar, lab tour, class exercises
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	Đại cương khoa học vật liệu, Các phương pháp chế tạo vật liệu
Module objectives/intended learning outcomes	Knowledge: Familiarity with basic knowledge about ceramic materials: crystal lattice structure, mechanical, thermal, electrical, optical, and chemical properties of ceramic materials Skills: Ability to analyze, explain and classify ceramic materials and their applications;
Content	Chapter 1: Introduction to Ceramic Materials; Chapter 2: Synthesis of Powdered Raw Materials; Chapter 3: Powder Homogenization and Ceramic Shaping Process; Chapter 4:

	Ceramics Sintering Process; Chapter 5: Manufactering ceramic by Sol-Gel Process
Examination forms	Participate fully in all classes (including extracurricular, laboratory): 10% Group seminar: 30% Class exercises: 10% Final examination: 50%
Study and examination requirements	• Students need to strictly comply with the rules and regulations of the Faculty and School. • Students are not allowed to miss more than 3 sessions out of the total number of theory sessions. • For any cheating during the assignment or exam, students mu
Reading list	Fundamental of Ceramic Powders Processing and Synthesis, Terry A. Ring, Academic Press, Toronto. Kỹ thuật sản xuất vật liệu gốm sứ, PGS.TS. Đỗ Quang Minh, NXB Đại học Quốc gia TP.HCM.

48. Metallic Materials and Alloys

Module designation	**Metallic Materials and Alloys** , MST10024
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Pham Kim Ngoc, PhD; Vu Hoang Nam, PhD
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, exercises
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	Modern Physics, General Materials Science, Fundamentals of Solid State Science
Module objectives/intended learning outcomes	In this course, students will gain a comprehensive understanding of the fundamental principles of metallic materials, with a particular focus on ferrous alloys. The course will explore the nature of metallic bonding and the crystal structures of metals. Additionally, the crystallographic characteristics of alloying elements and the concepts of phases and phase transformations in binary alloy systems will be examined. Students will also be introduced to the relationship between microstructure and material properties, as well as failure analysis techniques in steels and cast iron.

Content	1. Introduction to Metallic Materials (1 hours) 2. Metallic Bonds and Crystal Structures of Common Metals (1 hours) 3. Dislocations in Metallic Materials (1 hours) 4. Phases and Phase Transformations (3 hours) 5. Fundamentals of Substitutional and Interstitial Alloying (2 hours) 6. Binary Alloy Phase Diagrams (3 hours) 7. Ferrous Alloys (Steels and Cast Iron) (3 hours) 8. Mechanical Properties of Metals and Alloys (3 hours) 9. Strengthening of Metals and Alloys (2 hours) 10. Fracture and Failure mechanisms of Metals and Alloys (2 hours) 11. Non-ferrous Alloys (3 hours) 12. Heat Treatment and Surface Hardening Processes (3 hours) 13. Corrosion and Protection (3 hours)
Examination forms	Exercise, Disccusion, Written exam
Study and examination requirements	50 %
Reading list	Đặng Vũ Ngoạn, Vật liệu kỹ thuật, NXB ĐHQG-HCM, 2012 Nguyễn Khắc Xương, Vật liệu kỹ thuật: Chế tạo, cấu trúc, tính chất, lựa chọn và ứng dụng, NXB Bách Khoa Hà Nội, 2023 Lê Thị Chiều, Vật liệu kim loại kỹ thuật, NXB Bách Khoa Hà Nội

49. Tissue Engineering (updated)

Module designation	**Tissue Engineering, MST 10206**
Semester(s) in which the module is taught	6th semester
Person responsible for the module	PhD. To Minh Quan
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Discussion, Practice, Q&A
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour Private study including examination preparation, specified in hours: 1 lecture hour = 1 self-study hour 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	No
Module objectives/intended learning outcomes	Tissue Engineering is a multidisciplinary subject that merges biology, materials science, and engineering to create solutions for repairing or replacing damaged tissues and organs. Its main goal is to enhance or restore tissue function through the use of cells, engineered scaffolds, and biochemical agents. Students will learn about techniques such as cell cultivation, scaffold design, and the development of tissue-like systems. The course highlights the importance of cell-material interactions and the mechanisms of tissue repair. Key areas covered include stem cells, bioreactor technology, and real-world medical

	applications. Lab activities offer hands-on experience in building and evaluating tissue constructs. This course connects scientific research with clinical practice. It equips students for roles in fields like regenerative medicine, biotech, and biomedical engineering. Tissue Engineering is essential for the future of personalized healthcare and artificial organ development.
Content	Lesson 1: Introduction. Lesson 2: Stem cell: culture and application. Lesson 3: Biomaterial. Lesson 4: *In vitro* and *in vivo* test. Lesson 5: Bioreactor. Lesson 6: Application of tissue engineering in tissue regeneration. Less 7: Student's seminar.
Examination forms	Oral presentation, essay, discussion, attendance.
Study and examination requirements	Total score greater than or equal to 5.
Reading list	Công nghệ Vật liệu Sinh học Biomaterials Regenerative biology

50. Polymer and Composite Materials

Module designation	**Polymer and Composite Materials** , MST10030
Semester(s) in which the module is taught	5th semester
Person responsible for the module	HOANG Thi Dong Quy
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	KWL (Know, Want to know, Learn); Group discussion; Lectures; Video
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	General Chemistry, Organic Chemistry
Module objectives/intended learning outcomes	Recognize the basic knowledge about polymer/polymer composite materials; Describe the structure and property of polymer / polymer composite materials; Define the relationships between structures, states, and mechanical properties of polymer / polymer composite / nanocomposite materials; Arrange, operate, manage a group work independently and in groups to do major related discipline presentations; Prepare and present a scientific report/ project in group or individual • Participate in group discussion on specific subjects

	• Analyze and prepare reports on specific assigned topics individually or in group collaboration • (Use body language and tone of voice to enhance their presentations • Use slides and visual aids effectively • Deliver an enthusiastic and well-practised presentation!) Identify/explain the principles of chemical safety in polymer/polymer composite materials Explain the basic concepts, terms, tasks, and work ethics in polymer-composite materials science and technology; Apply basic knowledge in usage of polymer/ composite/ nanocomposite with awareness, under control and with less environmental impact
Content	Chapter 1: Course Overview; Introduction to Polymeric materials; Chapter 2: Free radical chain polymerization; Chapter 3: Step growth polymerization; Chapter 4: Functional Polymers; Chapter 5: Polymer composite materials; Chapter 6: Application of polymer/ polymer composite -nanocomposite materials in packaging, rubber, paint, textile, and functional polymers applied in high tech fields
Examination forms	Quiz or exercises at class (25%); Group seminar (25%); Final theoretical exam (50%)
Study and examination requirements	□ Student must be on time to class. There are no exceptions for being late. □ For each tardy less than 15 minutes, you will receive a 1% grade penalty. For each tardy more than 15 minutes, you will receive a day absence. Students absent more than 1/3 time
Reading list	1. Hoàng Ngọc Cường, Polyme Đại Cương, Nhà xuất bản ĐHQG TP. HCM, 2010. 2. Emo Chiellini, Helena Gil, Gerhart Braunegg, Johanna Buchert, Paul Gatenholm, and Maarten van der Zee,

	Biorelated polymers, Kluwer Academic / Plenum Publishers, 2001

51. Material simulation & modelling (updated)

Module designation	**Material simulation & modelling** , MST10015
Semester(s) in which the module is taught	Semester 5
Person responsible for the module	PhD. Tran Thị Minh Thu
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 15 hour(s) Exercise: 30 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.5 ECTS
Required and recommended prerequisites for joining the module	Thermodynamics
Module objectives/intended learning outcomes	Knowledge: fundamental theory, modeling and simulation for nano materials and biology systems using classical molecular dynamic methods. Skills: analyzing, predicting the simulation result; discussing, comparing to other publications; use MD simulation methods to set up and study the structure and function of nano materials/ biomolecules systems. Competences: integration of knowledge, skills and social and methodological capacities in working or learning situations
Content	Chapter 1: Introduction

	Lesson 1.1: Materials Science, Statistical Physics, and Molecular Dynamics Simulations Lesson 1.2: Molecular dynamics simulation methods: Algorithms Lesson 1.3: Molecular dynamics simulation methods: Force Fields and Software Packages Lesson 1.4: Molecular dynamics simulation techniques: setup for material systems Chapter 2: Simulations of Biomolecular Systems Lesson 2.1: Using Gromacs software Lesson 2.2: Practical Molecular Simulations of Biomolecular Systems using Gromacs software Chapter 3: Simulations of Thin Film Material Systems Lesson 3.1: Using LAMMPS software Lesson 3.2: Practical Simulations of Material Systems using LAMMPS software Chapter 4: Project Presentation and Final review Guidelines for Course Project Project Presentation Final Review
Examination forms	Oral presentation, Essay, Project
Study and examination requirements	Attend class (>70% contact hours). Complete task performance (Seminar). Mid-term examination > 03 points (03/10) and Final examination > 5 points (05/10).
Reading list	1. Understanding Molecular Simulation: From Algorthim to Application, D. Frenkel and B.Smit, Academic Press, Second Edition, 2005. 2. Molecular Modeling and Simulation_ An Interdisciplinary Guide, Tamar Schlick, Springer, Second Edition, 2010.

52. Semiconductor Materials

Module designation	**Semiconductor Materials** , MST10026
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Pham Kim Ngoc; Vu Hoang Nam
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, Assignments, Homework, Discussion
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	Modern Physics, General Materials Science, Fundamentals of Solid State Science
Module objectives/intended learning outcomes	This course explores the fundamentals of semiconductor physics and engineering, which are esseantial to understand semiconductor materials After completing the course, students will be able: to distinguish between different types of semiconductor materials and understand the origins of their various properties based on their crystal and electronic structures. to understand carrier generation mechanism and physics of carrier transport

	to understand the experimental methods used to determine the basic parameters of semiconductor materials. to understand the basis fabrication process used to obtain crystalline semiconductors. to understand formation of metal-semiconductor and p-n interfaces and construct energy band diagrams of these interfaces.
Content	Chapter 1: Basic Properties of Semiconductors (6 hours) Chapter 2: Types of Semiconductors (3.5 hours) Chapter 3: Excess Carriers in Semiconductors (5 hours) Chapter 4: Carrier Transport in Semiconductors (5 hours) Chapter 5: Applications of Semiconductors (6 hours) Chapter 6: Characterization of Semiconductors (6 hours) Chapter 7: Semiconductor Growth Techniques (6 hours)
Examination forms	Homework Assignments, Discussion, Written exam
Study and examination requirements	Final scores >= 50 %
Reading list	Phùng Hồ, Phan Quốc Phô; Giáo trình vật liệu bán dẫn; NXB Khoa học và Kỹ thuật, 2008 Phùng Hồ, Phan Quốc Phô; Vật lý bán dẫn; NXB Đại học Bách khoa Hà Nội, 2013 B. G. Yacobi; Semiconductor Materials-An Introduction to Basic Principles, Kluwer Academic Pub

53. Smart Materials and Applications

Module designation	**Smart Materials and Applications** , MST10171
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Trần Duy Tập
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, discussions, Teaching through topics and scientific articles
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	General goal: Smart materials are increasingly widely applied in electronic devices, computers, communications, transportation, construction projects, life sciences, and even construction. smart city, etc. The course Smart Materials and Applications provides students with knowledge and skills related to concepts, structures, properties, mechanisms or operating principles, synthesis and analysis methods as well as application of smart materials. The course helps students understand and describe the responses or responses of smart materials when there are environmental stimuli, thereby

	manipulating, designing, synthesizing, proposing, and applying them in science and life. Learning outcomes: Distinguish and explain the concepts, structures, properties and operating mechanisms of smart materials. Evaluate the necessary characteristics and influencing factors of smart materials. Propose which types of smart materials can be applied in specific situations in science and life. Know English terms and concepts related to the subject. Scientific discussion and criticism. Be aware of your own responsibility in learning and lifelong self-study. Use materials consciously, in a controlled manner, and contribute to environmental protection.
Content	Chapter 1: Shape memory materials. Chapter 2: Self-healing materials. Chapter 3: piezoelectric materials. Chapter 4. Photochromic materials. Chapter 5. Thermochromic materials.
Examination forms	Seminar, Discussion, Attendance
Study and examination requirements	Total score greater than or equal to 5.
Reading list	Jasprit Singh, Smart electronic materials – fundamental and application, Cambridge University Press, 2005. Wen-Chang Chen, Electrical Memory Materials and Devices, RCS, 2015. Myer Kutz, Smart materials, John Wiley & Sons, 2006. D. Michelle Addington, Dani

54. Materials recycling technologies (updated)

Module designation	**Materials recycling technologies (MST10178)**
Semester(s) in which the module is taught	8th semester
Person responsible for the module	Vu Nang An & Pham Huy Lam
Language	Vietnamese
Relation to curriculum	Elective/specialized
Teaching methods	lecture and seminar
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercises: 15 hours Private study including examination preparation, specified in hours[2]: 60
Credit points	3.25 ETCS
Required and recommended prerequisites for joining the module	• Polymer and composite materials • Metal and alloy materials
Module objectives/intended learning outcomes	Students understand the methods and applications of each material recycling method, especially polymer materials and polymer composites. Students can learn in-depth when working in manufacturing plants or research institutions on material recycling. Students can select the most suitable recycling method for each type of material. Students can predict the changes in the properties of materials after recycling to use them for their intended purposes.

[2] When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.

Content	Lesson 1: Environmental Pollution Issues – Sustainability in Material Use Lesson 2: Recycling metal materials Lesson 3: Some real cases of metal material recycling process Lesson 4: Current status of environmental pollution caused by polymer materials and solutions Lesson 5: Mechanical recycling of polymer materials, polymer composites Lesson 6: Thermal decomposition of polymer materials Lesson 7: Liquefying plastic waste Lesson 8: Dissolution-based approaches to plastic recycling Lesson 9: Chemical recycling of polyester to monomers
Examination forms	oral presentation, essay, and multiple choice question
Study and examination requirements	Final score: >= 5
Reading list	R.A. Ilyas, S.M. Sapuan, and Emin Bayraktar, "Recycling of Plastics, Metals, and Their Composites"CRC Press (2022)_ English Hoàng Ngọc Cường, "Công nghệ Tổng hợp và tái chế Polymer"Nhà xuất bản ĐHQG TP. HCM (2010)_ Vietnamese

55. Industrial Internship (updated)

Module designation	**Industrial Internship**, MST10112
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Trần Thị Thanh Vân Hà Thúc Chí Nhân Nguyễn Thái Ngọc Uyên
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Practical work at the enterprise, mentoring, seminars, project work
Workload (incl. contact hours, self-study hours)	Internship at Enterprise: 45 hours Guidance & Seminars (at University): 22.5 hours Self-study & Report Writing: 22.5 hours
Credit points	5.25 ECTS
Required and recommended prerequisites for joining the module	· Methods for analyzing material properties · Mechanical properties of polymers · Material processing techniques · Internship in material manufacturing methods · Quality management systems
Module objectives/intended learning outcomes	● Module objectives: This course provides students with practical knowledge at enterprises about technologies, material manufacturing processes, and product production; methods for analyzing the properties of materials; procedures and methods for inspecting/evaluating product quality. At the same time, students can grasp and fully understand the production activities from the input raw materials to the output of a business's final products.

	• Intended learning outcomes: • Apply theoretical knowledge of materials science and technology to analyze and describe real-world industrial processes. • Analyze the relationship between material selection, manufacturing techniques, and the final product's performance and quality. • Evaluate the efficiency, challenges, and potential improvements of a specific process or system observed at the enterprise. • Critically reflect on the professional working environment, safety standards, and management practices, comparing them with academic knowledge. • Communicate effectively both orally and in writing through a structured technical report and a professional presentation.
Content	The module content focuses on providing students with practical experience at businesses related to the field of Materials. The main topics include: **I. Overview of the Enterprise:** • Introduction to the enterprise, its main activities, products, services, and work processes. • Understanding the organization, management structure, and company regulations. • Comparing company regulations with academic regulations. **II. Material Production and Fabrication Processes:** • Studying real-world technologies, material manufacturing processes, and product production at the enterprise. • Learning about the equipment and machinery used in the production process.

	• Participating in specific steps within the production/operational process under the guidance of enterprise staff. **III. Material/Product Quality Analysis and Control:** • Understanding methods for analyzing material properties applied at the enterprise. • Studying procedures and methods for product quality inspection and evaluation. • Participating in activities involving raw material inspection, process control, and finished product inspection. **IV. Management and Operational Aspects:** • Market analysis related to the enterprise's products. • Learning about product design and project management. • Assessing production capacity and risk management. • Developing work progress schedules and managing time. • Considering the environmental impact of the production process. • Understanding the importance of employee training and intellectual property. • Establishing feedback mechanisms during the work process. **V. Data handling and Reporting:** • Collecting data and information related to internship activities. • Developing scientific internship reports, presenting results and observations."
Examination forms	· **Company activity:** Accounts for 20% of the total grade. This includes questions related to the company's operations, production processes, regulations that differ from school, specific tasks performed by the student, and a comparison of the enterprise's scale with the university's laboratories. It

	also requires a written report on the internship process and an evaluation from the direct supervisor at the company. · **Mid-term exam:** Accounts for 30% of the total grade. Students will submit a complete report on their internship process at the company, and the company's manager or director who directly supervises the student will provide feedback on the internship process. · **Final exam:** Accounts for 50% of the total grade. Students will present production processes such as the manufacturing process, the production process for finished products, steps for product quality assessment at the company, issues to consider during product manufacturing before market launch, and important considerations before product production.
Study and examination requirements	● · Students must strictly comply with the rules and regulations of working at the Enterprise. ● · Complete a minimum of 90 hours of internship at the approved enterprise. | ● · Obtain a positive evaluation from the enterprise supervisor. ● · Submit a complete Internship Portfolio and Final Report that meets the quality standards. ● · Achieve a minimum score of 5.0/10 overall.
Reading list	· Faculty's Guide for Internship Report Writing. · Alley, M. *The Craft of Scientific Writing*. 4th ed., Springer, 2018 · ASM Handbook, Volume 20: Materials Selection and Design.

56. Study with Enterprises

Module designation	Study with Enterprises, MST10129
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Ph.D Bui Thanh Son
Language	Vietnamese
Relation to curriculum	Compulsory course
Teaching methods	Discussion, Q&A
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 0 hour(s) Laboratory: 15 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	No
Module objectives/intended learning outcomes	General objective: Provide students with an overview of the research and application of various materials in societal life. Specific objectives: Students are able to read and comprehend specialized materials related to the course. They have the skills to work individually and collaboratively in teams to present reports and critically analyze topics
Content	Lesson 1: Basic process of rubber blending applied in the footwear industry and future trends. Lesson 2: Overview of the adhesive process used in the footwear industry and future trends

	Lesson 3: Technology of Jewelry and Gemstone Materials. Lesson 4: Career Orientation Lesson 5: Overview of the origin and production process of fabric, some basic mechanical-physical tests, and current applications in fabric production. Lesson 6: Presentation skills. Lesson 7: Introduction to the production process of polyvinyl chloride (PVC) compounds, applications of PVC in various industries, and future trends. Current status of the PVC industry in Vietnam and globally. Opportunities for Materials Science students in the field
Examination forms	Test and Oral presentation
Study and examination requirements	Total score greater than or equal to 5.
Reading list	Documents from business

57. Semiconductor Device Fabrication and Evaluation Practice

Module designation	**Semiconductor Device Fabrication and Evaluation Practice**, MST10305
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Assoc. Prof. Pham Kim Ngoc, Dr. Le Thai Duy.
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Discussion, Practice, Q&A
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 0 hour(s) Exercise: 0 hour(s) Laboratory: 60 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	4 ECTS
Required and recommended prerequisites for joining the module	(MST10026) Semiconductor materials (MST10017) Analytical Techniques for Investigating Material Structure and Morphology (MST10018) Analytical Techniques for the Characterization of Material Properties.
Module objectives/intended learning outcomes	This course provides students with hands-on experience in utilizing various technologies for the fabrication of semiconductor devices (such as resistors and transistors), including photolithography techniques (etching and lift-off), surface treatment processes, and more. In addition, students will practice analyzing the properties of semiconductor devices. Through this course, students will gain practical experience in fabricating common semiconductor devices,

	thereby enhancing their competitiveness and increasing their employment opportunities in the semiconductor and electronics industries.
Content	**Chapter 1:** Practical Training in the Fabrication and Evaluation of Thin-Film Transistors ● Exercise 1.1: Fabrication of Graphene Transistors on SiO_2 Substrates ● Exercise 1.2: Electrode Patterning via Lift-Off Photolithography Technique (Conducted at Linh Trung Campus) ● Exercise 2: Analysis of Current–Voltage Characteristics of Transistors (Conducted at Nguyễn Văn Cừ Campus) ● Exercise 3.1: Deposition of Photosensitive Materials onto Devices ● Exercise 3.2: Measurement of Photodetector Response (Conducted at LT/NVC Campus) **Chapter 2: Cleanroom Practice** ● Exercise 4: Mask Design for Photolithography (Conducted at INT) ● Exercise 5.1: Cleanroom Protocols and Safety Guidelines ● Exercise 5.2: Operation of Mask Aligner and UV Exposure Systems in the Cleanroom (Conducted at INT) ● Exercise 6: Wire Bonding Techniques for Microelectronic Devices (Conducted at INT)
Examination forms	Oral presentation, essay, discussion, attendance.
Study and examination requirements	A minimum attendance of 80% is required for course completion.
Reading list	Lecture notes

58. Semiconductor Devices Packing Technology

Module designation	**Semiconductor Devices Packing Technology,** MST10301
Semester(s) in which the module is taught	6th semester
Person responsible for the module	PhD. Đặng Vinh Quang; PhD. Lê Thái Duy
Language	Vietnamese
Relation to curriculum	Elective, Semiconductor Tech. Specialization
Teaching methods	Lecturing
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 60 hour 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	No
Module objectives/intended learning outcomes	General objective: This course introduces students to packaging technologies for electronic components after manufacturing. It also provides students with the requirements for packaging materials, including the characteristics of materials such as organic substrates, ceramic substrates, conductive frames, metal solder, sealing materials, adhesive materials, and various methods for packaging electronic components..

Content	Lesson 1: Introduction to packaging technology Lesson 2: Technology steps performed after manufacturing Lesson 3: Selection of packaging technology Lesson 4: Chip bonding, wire bonding, and encapsulation Lesson 5: Some rules in packaging MEMS devices Lesson 6: Packaging of digital micromirror devices (DMD) Lesson 7: Packaging of microelectronic components Lesson 8: Exercise
Examination forms	Oral presentation, essay, discussion, attendance.
Study and examination requirements	Total score greater than or equal to 5.
Reading list	Vũ Ngọc Hùng, Công nghệ vi hệ thống cơ điện tử, 2016; Nadim Maluf, Kirt Williams, Artech House, An introduction to Microelectromechanical system Engineering, 2004; Md Saquib Hasnain, Amit Kumar Nayak, Saad Alkahtani, Carbon Nanostructures in Biomedical Applications, Springer

59. Semiconductor devices (updated)

Module designation	**Semiconductor devices,** MST10302
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Assoc. Prof. Pham Kim Ngoc, Dr. Le Thai Duy
Language	Vietnamese
Relation to curriculum	Elective, Semiconductor Tech. Specialization
Teaching methods	Lecturing
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 60 hour 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	No
Module objectives/intended learning outcomes	General objective: This course provides knowledge related to semiconductor materials, the classification of semiconductors, characteristic parameters of semiconductors, p-n junctions, metal-semiconductor contacts, as well as the structure and operating principles of various semiconductor devices such as diodes and types of field-effect transistors like JFET, BFET, MOSFET, and TFT.
Content	Chapter 1: P-N junction, Metal - Semiconductor contact

	Chapter 2: Structure, Principle and Characteristics of Diodes Chapter 3: Structure, Principle and Characteristics of FET, BFET, MOSFET Chapter 4: Structure, Principle and Characteristics of TFT. Chaper 5: Application of semiconductor devices in IC.
Examination forms	Oral presentation, essay, discussion, attendance.
Study and examination requirements	• Strictly follow the rules and regulations of Department as well as University. • Must not be absence more than 3 sessions of lectures. • For any cheating in the process of doing an assignment or an exam, students will be subjected to any disciplinary action by the Faculty / School and be assigned 0 for the assignment. • Students who miss any work will be compensated with valid reasons accepted.
Reading list	1. J. Stepek · H. Daoust. Additives for Plastics. Springer Science+ Business Media, LLC, 1983. 2. Jiri E. Kresta. Polymer Additives. Plenum Press, New York and London, 1984 3. Johan Bieleman. Additives for Coatings. Wiley-VCH, New York, 2000. 4. Paper publish in Journals

60. Polymer Additives and Polymer-Modified (updated)

Module designation	**Polymer Additives and Polymer-Modified,** MST10139
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Assoc. Prof. Hoang Thi Dong Quy, Nguyen Tuan An.
Language	Vietnamese
Relation to curriculum	Elective, Polymer Tech. Specialization
Teaching methods	KWL (Know, Want to know, Learn), Group discussion, Lectures, Seminar, Learning and dicussing with specialists from industries
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	Specialized subjects
Module objectives/intended learning outcomes	Explain the basic knowledge of additives used in polymer materials; Describe the compositions, properties, and applications of each additive; then classify and apply each type of additive used for specific polymer-composite materials in the process of synthesizing, processing, and using materials; Apply the basic knowledge to conduct in-depth research when working in manufacturing industry or research institutions for polymer - composite materials; Understand the major related discipline documents; Work

	independently and in groups to do major related discipline presentations; Explain the basic concepts, terms, tasks, and work ethics in polymer-composite materials science and technology; Set up, organize, operate and manage groups; Participate in group discussion on specific subjects; Analyze and prepare reports on specific assigned topics individually or in group collaboration.
Content	Chapter 1: Some concepts and classification of polymer additives; Chapter 2: Properties, structure, classification of polymers and additives; Chapter 3: Types of additives: Plasticizer, Fire retardant additives, Polymer anti-degradation stabilizer additive, Antimicrobial additives, Foaming/defoaming additives, Antistatic additives, Lubricant and release agent, Filler/reinforcing agent; Chapter 4 Application of polymer additives in packaging, rubber, paint, construction, and functional polymers applied in high tech fields
Examination forms	Oral presentation, essay, discussion, attendance.
Study and examination requirements	A minimum attendance of 80% is required for course completion.
Reading list	

61. Modeling and Simulation of Semiconductor Devices Practice

Module designation	**Modeling and Simulation of Semiconductor Devices Practice**, MST10306
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Tran Thị Minh Thu, PhD Le Thai Duy, PhD
Language	Vietnamese
Relation to curriculum	Elective, Semiconductor Tech. Specialization
Teaching methods	Discussion, Practice, Q&A
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 0 hour(s) Exercise: 0 hour(s) Laboratory: 60 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	4 ECTS
Required and recommended prerequisites for joining the module	No
Module objectives/intended learning outcomes	General objective: Students will be able to analyze the characteristics of semiconductor materials, such as energy band structure, carrier types, and Fermi energy level. They will also be able to analyze the characteristics of semiconductor devices, such as current-voltage behavior. Learning outcomes: Describe and explain the operating principles of semiconductor devices; Setup model the structure of semiconductor devices and simulate their characteristics; Demonstrate the ability to analyze data and present results; Evaluate the parameters affecting the

	effectiveness and efficiency of semiconductor devices; Work independently and work effectively in a team; Has ability to present issues with reasoning grounded in scientific principles.
Content	**Lesson 1:** Introduction and User Guide for NanoHUB. Overview of Semiconductor Material Simulation Tools. **Lesson 2:** DFT Calculations for Simulating the Band Structure of n-type and p-type Silicon. **Lesson 3:** Introduction to types of Semiconductor Devices. Modeling of the P-N Junction and Analysis of Its Characteristics. **Lesson 4:** Modeling of Bipolar Junction Transistors (BJTs) and Analysis of Their Characteristics. **Lesson 5:** Modeling of MOS Capacitors and Analysis of Their Characteristics. **Lesson 6:** Modeling of n-type and p-type MOS Transistors and Analysis of Their Characteristics. **Lesson 7:** Modeling of Single-Gate and Double-Gate MOS Transistors and Analysis of Their Characteristics.
Examination forms	Oral presentation, essay, discussion, attendance.
Study and examination requirements	Total score greater than or equal to 5.
Reading list	ABACUS - Assembly of Basic Applications for Coordinated Understanding of Semiconductors, Nanohub, https://nanohub.org/topics/EduSemiconductor ABACUS web interactive tool, Nanohub, https://nanohub.org/topics/EduSemiconductor

62. Microelectromechanical Systems (MEMS) Technology

Module designation	**Microelectromechanical Systems (MEMS) Technology**, MST10304
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Dr. Vinh Quang Dang
Language	Vietnamese
Relation to curriculum	Elective, Semiconductor Tech. Specialization
Teaching methods	Lecturing, discussion, seminar
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 60 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	General Materials Science, General Chemistry 1-2, Organic Chemistry, The Fundamentals of Solid State, Conductor – Semiconductor and Insulator Materials, Materials Synthesis Methods 1-2
Module objectives/intended learning outcomes	The course you study focuses on MEMS materials, the silicon fabrication process, and silicon wafers. It also introduces lithography techniques such as photolithography, electron beam lithography, soft lithography, and nanoimprint lithography to create microstructures and fabricate electronic components. Additionally, this course covers processes in surface micromachining, wet bulk micromachining

Content	Lesson 1: General the lithography techniques. Lesson 2: Photolithography Lesson 3: Ebeam lithography. Lesson 4: Soft lithography. Lesson 5: Nanoimprint lithography. Lesson 6: Dip pen lithography Lesson 7: Etching technique Lesson 8: Vacuum technique Lesson 9: Surface Micromachining Lesson 10: Bulk Micromachining
Examination forms	Oral presentation, essay, discussion, attendance.
Study and examination requirements	Total score greater than or equal to 5.
Reading list	1. Công nghệ vi hệ thống cơ điện tử, Vũ Ngọc Hùng, Nhà xuất bản Bách Khoa Hà nội, 2016 2. An introduction to Microelectromechanical system Engineering, Nadim Maluf, Kirt Williams, Artech House, Inc, 2004 3. Microsensors, MEMS, and Smart Devices, Julian W. Gardner, Vijay K. Varadan, Osama O. Awadelkarim, 2001 4. Micro Electro Mechanical System Design, James J. Allen, 2005

63. Energy Storage Materials

Module designation	**Energy Storage Materials**, MST10403
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Dr. Le Thai Duy, and Dr. Tong Hoang Tuan.
Language	Vietnamese
Relation to curriculum	Elective, Renewable Energy Tech. Specialization
Teaching methods	Lecturing, Discussion, Q&A
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	No
Module objectives/intended learning outcomes	This subject provides students with general knowledge about materials used in the field of energy storage (such as inorganic, organic, semiconductors, composite, nano, ...) and the working principle of material in energy storage devices. In addition, students will be provided with materials research skills (synthesized, analyzed, evaluated, ...) in order to improve the scale of archives, durability, convenience, fast and reduce the cost of energy storage equipment. After this subject, students will have knowledge and research skills to work at enterprises with production and business activities related to the field of energy storage materials or participate

	in teaching, training, and research at universities and research institutes.
Content	Chapter 1: Introduction of energy applications 1.1: General concepts; 1.2: Demands on energy. Chapter 2: Thermodynamics of energy generation and conversion; 2.1: Energy thermodynamics; 2.2: Storable forms of energy; 2.3: Materials capable of storing energy; 2.4. Limitations and challenges. Chapter 3: Methods of analyzing energy storage materials; 3.1: Properties of material; 3.2: Structure analysis; 3.3: Analysis of electrical properties; 3.4: Types of links; 3.5: Chemical and electrical properties; 3.6: Analysis of energy storage; 3.7: Durability. Chapter 4: Capacitor and Battery Materials - Electrical energy storage material 4.1: Overview of the field of electricity and electrochemical; 4.2: Overview of capacitors, super capacitors, and batteries; 4.3: Materials for electrode; 4.4: Analysis of energy density stored in the electrode; 4.5: Materials for super capacitors and batteries are capable and inability to reuse; 4.6. Potential, limitations, and challenges. Chapter 5: Green Fuels - Clean fuel 5.1: Fuel form; 5.2: Fuel components used and fuel storage and energy storage principles; 5.3: Hydrogen fuel and prospect of green hydrogen economy; 5.4: Hydrogen fuel synthesis and storage process; 5.5: Hydrogen fuel storage materials; 5.6: Hydrogen storage analysis; 5.7: Potential, restrictive, and challenges.
Examination forms	Oral presentation, essay, discussion, attendance.
Study and examination requirements	Total score greater than or equal to 5.
Reading list	- Iuliana Stoica, Ann Rose Abraham, A. K. Haghi. "ADVANCES IN ENERGY MATERIALS – New

	Composites and Techniques for Future Energy Applications." Apple Academic Press (2024). - Robert A. Huggins. "Energy Storage Fundamentals, Materials and Applications." Springer (2016). - John A. Kilner, Stephen J. Skinner, Stuart J. C. Irvine and Peter P. Edwards. "Functional materials for sustainable energy applications." Woodhead Publishing (2012)

64. Characterization of Energy Conversion and Storage Materials

Module designation	**Characterization of Energy Conversion and Storage Materials**, MST10406
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Assoc. Prof. Dr. Tran Duy Tap, Dr. Tong Hoang Tuan
Language	Vietnamese
Relation to curriculum	Elective, Renewable Energy Tech. Specialization
Teaching methods	Discussion, Practice, Q&A
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 0 hour(s) Exercise: 0 hour(s) Laboratory: 60 hour(s) Private study including examination preparation, specified in hours: 90 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	4 ECTS
Required and recommended prerequisites for joining the module	General Materials Science, General Chemistry 1-2, Organic Chemistry, The Fundamentals of Solid State, Materials Synthesis Methods 1-2
Module objectives/intended learning outcomes	This course will provide students with knowledge and skills in the fabrication of energy storage and conversion devices within the laboratory. At the same time, students practice evaluating the conversion efficiency and operating characteristics of the devices. From there, students can predict, design, fabricate and evaluate devices and components that store and convert energy safely and

	effectively. Compare and evaluate factors affecting the device.
Content	Lesson 1: Manufacturing of block thermoelectric components Lesson 2: Power rating and factors affecting thermoelectric components Lesson 3: Fabrication and evaluation of supercapacitor performance Lesson 4: Evaluation of solar cell conversion power Lesson 5: Analysis of structural characteristics of fuel cell materials Lesson 6: Analysis of the properties of fuel cell materials
Examination forms	Oral presentation, essay, discussion, attendance.
Study and examination requirements	Total score greater than or equal to 5.
Reading list	1. Le Quoc Hung, Phan Thi Binh, Vu Thi Thu Ha, Pham Hong Phong, ***Điện hóa học nâng cao***, Publishing House for Science & Technology, 2016. 2. Tran Dai Lam, Nguyen Tuan Dung, Nguyen Le Huy, Le Viet Hai, ***Các phương pháp phân tích hóa lý vật liệu***, Publishing House for Science & Technology, 2017.

65. Renewable Energy Storage Technology

Module designation	**Renewable Energy Storage Technology**, MST10405
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Dr. Le Thai Duy, and Dr. Tong Hoang Tuan.
Language	Vietnamese
Relation to curriculum	Elective, Renewable Energy Tech. Specialization
Teaching methods	Lecturing, Discussion, Q&A
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	2.25 ECTS
Required and recommended prerequisites for joining the module	• (MST10403) • (MST10402)
Module objectives/intended learning outcomes	This subject provides knowledge and skills related to equipment, components, operating principles and assessing the storage performance of electrochemical batteries, supercapacitors, air storage, heat storage, ... in solar, wind, tide, hydrogen, the subject will emphasize the importance of corresponding techniques and hybridization of materials in improving and optimizing energy storage equipment. After this subject, students will be able to choose and apply material technology in the design of energy storage system. Besides, students can work in enterprises related to technology and energy storage equipment.

Content	Chapter 1: Overview of energy storage system 1.1: General introduction of the main concepts and principles of energy storage; 1.2: Overview of application potential and comparison of storage time; 1.3: The importance of the electricity and transport energy storage system. Chapter 2: Thermal energy storage technology 2.1: Thermal storage system-heat pumps, hot water storage tank, and solar thermal collector; 2.2: Application of phase changes of material to store energy; 2.3: nuclear energy; 2.4: Evaluation of efficiency and economic potential of heat storage system. Chapter 3: Fuel storage technology 3.1: Fuel storage devices and systems; 3.2: The concept of solar storage in the form of fuel; 3.3: Application of chemical energy storage system; 3.4: Advantages, limitations, and future prospects. Chapter 4: Electromagnetic energy storage technology 4.1: Electromagnetic storage systems; 4.2: The advantages, limitations, and future prospects. Chapter 5: Electric Energy Technology 5.1: Battery operating principle; 5.2: Method of battery performance evaluation; 5.3: The operating principle of super capacitors; 5.4: Classification and evaluation of energy storage efficiency of supercapacitors (compared to battery); 5.5: Principle of operation of fuel cells; 5.6. Classification of equipment and integrated systems of fuel battery. Chapter 6: Material technology in optimizing design equipment and energy storage system 6.1: Overview of modifications and hybridization of materials; 6.2: Mechanical safety design, temperature management, and packaging to protect the energy storage system; 6.3: Technology of recycling energy storage materials.
Examination forms	Oral presentation, essay, discussion, attendance.

Study and examination requirements	Total score greater than or equal to 5.
Reading list	- Abdellatif Sadeq. "Energy Storage Systems: A Comprehensive Guide" (2023). - Frank S. Barnes, Jonah G. Levine. "Large Energy Storage Systems Handbook". CRC Press (2012)

66. Renewable Energy Systems and Their Impact on Economic and Environmental

Module designation	Renewable Energy Systems and Their Impact on Economic and Environmental, MST10401
Semester(s) in which the module is taught	7th semester
Person responsible for the module	PhD. Lê Khắc Tốp
Language	Vietnamese
Relation to curriculum	Elective, Renewable Energy Tech. Specialization
Teaching methods	Discussion, Practice, Q&A
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 37.5 hour(s) Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	No
Module objectives/intended learning outcomes	Nowadays, renewable energy systems play a important role in science, technology and life. This course aims to equip students with advanced basic architectures of renewable energy systems including solar energy, thermal power, wind power and fuel cell systems. In addition, this course also provides students with the impact of renewable energy on the environment and economy. This course provides students with opportunities for internships and practical training at factories, industry, and companies on renewable energy systems. Specifically, after completing the course, students will have in-depth knowledge of renewable energy groups, integrating devices in the system, thereby being able

	to orient, select, manufacture, evaluate and use the system of these devices. Complete this course, students have enough knowledge to work in the energy fields and research at schools, research institutes.
Content	Lesson 1: Traditional Energy Sources. Lesson 2: Renewable energy sources. Lesson 3: Advantages and disadvantages of renewable energy. Lesson 4: Solar, wind and mechanical energy systems. Lesson 5: System using thermal power, biomass and hydrogen. Lesson 6: Impact on air, water, and climate change. Lesson 7: Economic Impact. Lesson 8: Social Impact. Lesson 9: Challenges. Lesson 10: Future Directions
Examination forms	Oral presentation, essay, discussion, attendance.
Study and examination requirements	Total score greater than or equal to 5.
Reading list	1. Energy, Economics and Environmental Impacts of Renewable Energy Systems: • Varun Prakash, Ravi Bhat, and Inder Krishnan. "Energy, Economics and Environmental Impacts of Renewable Energy Systems." *Renewable Sustainable Energy Rev.*, vol. 13, no. 9, 2009, pp. 2716-2721. • "Energy, Economics and Environmental Impacts of Renewable Energy Systems." *Renewable Sustainable Energy Rev.*, vol. 13, no. 9, 2009, pp. 2716-2721. 2. Social, Economical and Environmental Impacts of Renewable Energy Systems: • "Social, Economical and Environmental Impacts of Renewable Energy Systems." *IntechOpen*, 2018. • "Social, Economical and Environmental Impacts of Renewable Energy Systems." *ResearchGate*, 2018. 3. Case Studies and Examples:

	• Chilán JCH, et al. "Social Impact of Renewable Energy Sources in the Province of Loja: Ecuador." *Int. J. Phys. Sci. Eng.*, vol. 2, no. 1, 2018, pp. 13-25. • Zeb R, et al. "Causal Links between Renewable Energy, Environmental Degradation and Economic Growth in Selected SAARC Countries." *Renewable Energy*, vol. 71, 2014, pp. 123-132. 4. Assessment of Sustainability Indicators: • Bilgil F, et al. "The Dynamic Impact of Renewable Energy Consumption on CO2 Emissions: A Revisited Environmental Kuznets Curve Approach." *Renewable Sustainable Energy Rev.*, vol. 54, 2016, pp. 838-845. • Frondel M, et al. "Economic Impacts from the Promotion of Renewable Energy Technologies: The German Experience." *Energy Policy*, vol. 38, 2010, pp. 4048-4056. 5. Life Cycle Assessment and Environmental Impacts: • "Life Cycle Assessment of a Medium-Sized Photovoltaic Facility at a High Latitude Location." *ASME J. Energy Resour. Technol.*, vol. 130, no. 4, 2008, pp. 041001. • Evans A, et al. "Life Cycle Assessment of a Small Hydro Power Plant." *Renewable Sustainable Energy Rev.*, vol. 13, no. 9, 2009, pp. 1082-1088. 6. Cost and Life Cycle Analysis: • Shahzad SJ, et al. "Carbon Emission, Energy Consumption, Trade Openness and Financial Development in Pakistan: A Revisit." *Renewable Sustainable Energy Rev.*, vol. 70, 2017, pp. 185-192. • Yazdanie M. "Renewable Energy in Pakistan: Policy Strengths, Challenges & the

	Path Forward." *Renewable Energy*, vol. 35, no. 1, 2010, pp. 1-8.

67. **Basic Integrated Circuits**

Module designation	**Basic Integrated Circuits**, MST10307
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Dr. Le Duc Hung
Language	Vietnamese
Relation to curriculum	Elective, Semiconductor Tech. Specialization
Teaching methods	Lecture, Discussion, Practice, Q&A
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 0 hour(s) Laboratory: 15 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	
Module objectives/intended learning outcomes	This course provides students with hands-on experience in utilizing various technologies for the fabrication of semiconductor devices (such as resistors and transistors), including photolithography techniques (etching and lift-off), surface treatment processes, and more. In addition, students will practice analyzing the properties of semiconductor devices. Through this course, students will gain practical experience in fabricating common semiconductor devices, thereby enhancing their competitiveness and increasing their employment opportunities in the semiconductor and electronics industries.

Content	Lesson 1: Integrated Circuit Design Process Lesson 2: Semiconductor Electronic Components Exercise 1 Lesson 3: Logic Gates and Basic Integrated Circuits (Part 1) Lesson 3: Logic Gates and Basic Integrated Circuits (Part 2) Exercise 2 Lesson 4: Integrated Circuit Design (Part 1) Lesson 4: Integrated Circuit Design (Part 2) Exercise 3 Exercise 4 Lesson 4: Integrated Circuit Design (Part 3) Exercise 5 Review Session
Examination forms	Oral presentation, essay, discussion, attendance.
Study and examination requirements	A minimum attendance of 70% is required for course completion.
Reading list	Peter Shepherd, Integrated Circuit: Design, Fabrication, and Test, McGraw-Hill, 1996 (Main Textbook). Neil Weste, David Harris, CMOS VLSI Design: A Circuits and Systems Perspective 4th Edition, Pearson, 2010 (Reference)

68. Coating Technology

Module designation	**Coating Technology,** MST10121
Semester(s) in which the module is taught	8th semester
Person responsible for the module	PhD. Nguyen Thai Ngọc Uyen
Language	Vietnamese
Relation to curriculum	Elective, Polymer Tech. Specialization
Teaching methods	Lectures, case studies, discussion, Q&A
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hours Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	**Polymer and Composite Materials, Polymer Blends, Polymer Additives**
Module objectives/intended learning outcomes	Students will gain an understanding of the structure and properties of polymers used in the production of paints, varnishes, and adhesives. They will also learn to identify and classify different types of these materials, along with comprehending the fundamental principles of adhesion. Throughout the course, students will develop both individual and teamwork skills by researching, discussing, and presenting reports on relevant topics.
Content	This course provides students with specialized knowledge of polymer materials used in the fields of coatings, varnishes, and adhesives. Based on this foundation, students will be able to pursue in-depth study and professional work in

	manufacturing plants or research institutes related to these materials. The course covers the composition, structure, adhesion principles, properties, analytical methods, testing techniques, and practical applications of paints, varnishes, and adhesives in everyday life.
Examination forms	Midterm exam (50%) Final exam (50%)
Study and examination requirements	Total score greater than or equal to 5.
Reading list	1. R. Lambourne and T A Strivens, Paint and surface coatings Theory and Practice, William Andrew Publishing (2000). 2. Fred A. Keimel, Handbook of Adhesive Technology, second edition, Taylors & Francis Group (2003). 3. A.R. Marrion, The chemistry and physics of coatings, Second Edition - RS-C advancing the chemical sciences (2004). 4. D.E. Packham, Handbook of adhesion Second Edition – John Wiley & Sons, Ltd (2006).

69. Packaging materials and Technologies

Module designation	**Packaging materials and Technologies,** MST10172
Semester(s) in which the module is taught	8th semester
Person responsible for the module	PhD. Do Thi Vi Vi
Language	Vietnamese
Relation to curriculum	Elective, Polymer Tech. Specialization
Teaching methods	Lectures, case studies, discussion, Q&A
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hours Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	Methodes for synthesis of organic polymer**,** Polymer Mechanical and Physical Properties
Module objectives/intended learning outcomes	This course provides knowledge of materials used in the packaging industry, packaging production methods, packaging technology, and methods for evaluating packaging properties.
Content	This course provides foundational knowledge about materials used in packaging technology. Students will gain an understanding of the role and functions of packaging, as well as the properties of packaging materials, packaging technology, methods of packaging production, and the application of these methods to different types of products. Upon completion of the course, students will be able to explore, learn, and conduct basic research related to the packaging industry. Additionally, the course helps students

	develop teamwork skills and the ability to analyze issues relevant to the packaging field.
Examination forms	Midterm exam (50%) Final exam (50%)
Study and examination requirements	Total score greater than or equal to 5.
Reading list	1. Packaging Technology: Fundamentals, Materials and Processes, Elsevier Science (2012). 2. John R. Wagner Jr., Flexible_Packaging Technology and Applications for the Food, Plastics Design Library (2010). 3. Basu Bikramjit, Katti Dhirendra, Advanced biomaterials: fundamentals, processing, and applications, John Wiley & Sons, Inc. Publication (2009).

70. Nanomaterials and Nanotechnology

Module designation	**Nanomaterials and Nanotechnology**, MST10174
Semester(s) in which the module is taught	8th semester
Person responsible for the module	Dr. Tong Hoang Tuan
Language	Vietnamese/English
Relation to curriculum	Elective
Teaching methods	Discussion, Practice, Q&A
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	● Fundamentals of Physics 1 & 2 ● Fundamentals of Chemistry 1 & 2
Module objectives/intended learning outcomes	General objective: ● This course aims to provide a comprehensive overview of nanomaterials in terms of the properties, synthesis, characterization, and applications. It will cover the fundamental scientific principles for the new physical and chemical properties at the nanoscale, different synthesis techniques, assembly of nanostructured materials and,. Existing and emerging applications will also be discussed through case studies. ● Upon completing this course, students will understand the foundation, principles and societal impact of

	the nanoscience and nanotechnology. They are also able to apply theoretical knowledge to find suitable approaches for the synthesis and characterization of nanomaterials.
Content	Lesson 1: Introduction to Nanotechnology. Lesson 2: Properties of Nano materials. Lesson 3: Synthesis and Fabrication. Lesson 4: Characterization Techniques. Lesson 5: Applications of Nanotechnology.
Examination forms	Oral presentation, essay, discussion, attendance.
Study and examination requirements	Total score greater than or equal to 5.
Reading list	1. Charles P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology, Wiley-Interscience 2003 2. Hornyak Gabor L., Tibbals H.F., Dutta Joydeep, Moore John J., Introduction to Nanoscience, CRC Press 2008 3. Sneha Bhagyaraj, Oluwatobi Samuel Oluwafemi, Nandakumar Kalarikkal, Sabu Thomas, Synthesis of Inorganic Nanomaterials advances and key technologies, Woodhead Publishing, Elsevier 2018

71. Flexible Electronic Devices

Module designation	Flexible Electronic Devices, MST10177
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Dr. Dang Vinh Quang, and Dr. Le Thai Duy.
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecturing, Discussion, Q&A
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	No
Module objectives/intended learning outcomes	Deformable electronic components are important components that contribute to changing the game in the current technology world. This subject will provide the knowledge of the design of flexible electronic components and the role of selecting materials for their function, processing and deformation sustainability. In addition, the subject will emphasize the development potential and future direction of flexible components and can be applied in the field of health monitoring. Through this subject, students will understand semiconductors (inorganic and organic) and describe the design of flexible components and devices. In

	addition, students will be able to understand how to apply science and technology to emerging flexible electronics and can identify sensor components that have been applied in the field of health monitoring.
Content	Chapter 1: Overview of flexible electronic components Lesson 1.1: History of Development; Lesson 1.2: Overview and prospect of technology; Lesson 1.3: Theory of mechanical deformation of materials Chapter 2: Classification of materials in flexible components Lesson 2.1: Classification of flexible materials according to elastic limits; Lesson 2.2: Flexible materials capable of elasticity (Stretchable); Lesson 2.3: Flexible materials capable of healability. Chapter 3: Technology and manufacturing process Lesson 3.1: Solution processes and nanopatterning methods; Lesson 3.2: Micro and Nano fabrication on flexible substrates; Lesson 3.3: Printing stretchable electronic systems; Lesson 3.4: Coating and encapsulation. Chapter 4: Soft robotics Lesson 4.1: Sensors; Lesson 4.2: Operation and sensing mechanisms; Lesson 4.3: Soft actuators and control; Lesson 4.4: Soft interactions and soft robot assistants. Chapter 5: Flexible and Stretchable Bioelectronics Lesson 5.1: Bioelectronics and bio-compatible materials; Lesson 5.2: Implantable bioelectronic; Lesson 5.3: Electronic skin. Chapter 6: Applications of Integrated Flexible Systems Lesson 6.1: The wearable health monitoring system; Lesson 6.2: Wireless applications and the IoT sensors; Lesson 6.3: Human-machine interfaces.
Examination forms	Oral presentation, essay, discussion, attendance.
Study and examination requirements	Total score greater than or equal to 5.

Reading list	- Dao Huy Bich. “Lý thuyết dẻo và các ứng dụng.” Hanoi Publishing House (2004). - Harry L. Tuller. “Flexible Electronics: Materials and Applications”. Springer (2009) - Katsuyuki Sakuma. “Flexible, Wearable, and Stretchable Electronics“. CRC Press (2020)

72. Biomedical Sensors and Evaluation Techniques

Module designation	**Biomedical Sensors and Evaluation Techniques,** MST10205
Semester(s) in which the module is taught	7th semester
Person responsible for the module	PhD. Tran Thi Nhu Hoa
Language	Vietnamese
Relation to curriculum	Elective, Biomedical course
Teaching methods	KWL (Know, Want to know, Learn), Group discussion, Lectures, Seminar, Learning and dicussing with specialists from industries
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	No
Module objectives/intended learning outcomes	General Objectives: Provide students with basic knowledge of biomedical sensors, including classification, technical parameters, and operating mechanisms. Develop skills in searching for, utilizing, processing, and applying information related to the course content. Build teamwork skills.

Content	Lesson 1: Introduction to Biomedical Sensors Lesson 2: Wearable Mobile Sensors Lesson 3: Blood Pressure Sensors Lesson 4: Optical Fiber Sensors
Examination forms	Oral presentation, essay, discussion, attendance.
Study and examination requirements	A minimum attendance of 80% is required for course completion.
Reading list	□ Harsanyi, G. (2000). *Sensors in biomedical applications: Fundamentals, technology and applications*. CRC Press. □ Feng, D. D. (2020). Biomedical sensors. In *Biomedical information technology* (2nd ed., pp. [insert page numbers]). Elsevier B.V. □ Kumar, S., Agrawal, N., Saha, C., & Jha, R. (2023). *Optical fiber-based plasmonic biosensors: Trends, techniques, and applications*. CRC Press.

73. Innovation and Entrepreneurship

Module designation	**Innovation and Entrepreneurship** , MST10137
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Invited entrepreneurs, Ha Thuc Chi Nhan, PhD
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lectures Case studies Group discussions Project-based learning
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 15 hour(s) Exercise: 0 hour(s) Laboratory: 30 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.5 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Upon successful completion of this module, students will be able to: ● Understand the role of innovation and entrepreneurship in the field of materials technology. ● Identify opportunities for innovation in materials science, such as advanced materials, sustainable materials, and nanotechnology.

	● Develop an entrepreneurial mindset and apply it to materials-related industries. ● Analyze the process of developing and commercializing new materials and technologies. ● Create a business model or commercialization plan for a materials-based innovation.
Content	● Introduction to innovation and entrepreneurship in materials technology ● Characteristics of successful entrepreneurs in the materials industry ● Creativity and idea generation for new materials and applications ● Business model development for materials-based startups ● Market research and validation for new materials and technologies ● Intellectual property and patents in materials innovation ● Financing new ventures in materials technology ● Sustainable innovation and green materials ● Case studies of successful materials-based startups and innovations
Examination forms	Business model or commercialization plan development and presentation
Study and examination requirements	Active participation in class discussions and activities Completion of assignments and case studies on materials technology innovations Final scores >= 5
Reading list	Lecture notes

74. Sensor Technology and Applications

Module designation	**Sensor Technology and Applications** , MST10175
Semester(s) in which the module is taught	6th semester
Person responsible for the module	La Phan Phương Hạ
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	lecture, discussion, seminar
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	General Materials Science
Module objectives/intended learning outcomes	This course provides students with fundamental knowledge of common types of sensors and certain materials used in sensor fabrication. It covers the basic structure and operating principles of various sensors.
Content	Students will: ● Understand the basic structure and working principles of selected sensors. ● Identify factors affecting the properties of different sensor types.

	• Learn about certain nanostructured materials applied in sensor technology.
Examination forms	Final exam, Group presentation, Assignments
Study and examination requirements	Total scores >= 5
Reading list	Handbook of modern sensors (Jacob Fraden), Cảm biến và ứng dụng theo xu hướng hiện đại (TS Lê Ngọc Bích), Giáo trình cảm biến (Phan Quốc Phô)

75. Machine Learning in Materials Science

Module designation	**Machine Learning in Materials Science** , MST10176
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Dr. Tran Thi Minh Thu
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	lecture, lesson, project
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	Quantum physics , Thermodynamics, Linear algebra
Module objectives/intended learning outcomes	Knowledge: basic concepts in machine learning and techniques for constructing feature vectors for data Skills: familiar with machine learning models and have a preliminary view of building machine learning models to predict the structure of material systems at a basic level Competences: integration of knowledge, skills and social and methodological capacities in working or learning situations
Content	This course introduces basic concepts in machine learning and techniques for constructing feature vectors for data. The course helps students become familiar with machine learning

	models and have a preliminary view of building machine learning models to predict the structure of material systems at a basic level.
Examination forms	oral presentation, essay, project, exercise
Study and examination requirements	Total mark >=5
Reading list	Pattern Regconigtion for machine learning, Christopher M. Bishop , 2006

76. Polymer Material Analysis Techniques

Module designation	**Polymer Material Analysis Techniques** , MST10138
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Hoàng Thị Đông Quỳ
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Listening, Taking Notes, Solve assignments
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	Polymer and composite materials; Materials Characterization Techniques 1; Materials Characterization Techniques 2.
Module objectives/intended learning outcomes	Distinguish each analysis method; Evaluate advantages and disadvantages of each analysis method; Select analysis methods and how to prepare sample; Describe the process to prepare sample; Interpret of structures, contents of some common polymers from analysis data; Interpret of thermal properties of some common polymers from analysis data

Content	Chapter 1. Introduction of polymer analysis methods (1 hours); Chapter 2. Characterization of polymers by FTIR method (6 hours); Chapter 3. Characterization of polymers by Raman spectroscopy method (5 hours); Chapter 4. Characterization of polymers by NMR spectroscopy method (2 hours); Chapter 5. Characterization of polymers by DSC method (5 hours); Chapter 6. Characterization of polymers by TGA method (4.5 hours).
Examination forms	Testing in class (20%); Midterm examination (30%); Final examination (50%).
Study and examination requirements	Students, who are absent more than 30% of total teaching hours, are not allowed to get final assessment; Students should take a ruler, a pocket calculator to solve assignments; Students, who do not participate midterm exam, are not allowed to take the fi
Reading list	1. Hoàng Ngọc Cường, Phân tích polyme bằng các phương pháp nhiệt DSC, TGA và DMA, Publisher Vietnam national university - Ho Chi Minh city, 2015; 2. Hoàng Ngọc Cường, Phân tích polyme bằng các phương pháp phổ FTIR, Raman và NMR, Publisher Vietnam national

77. Polymer Blends and Thermoplastic Elastomers

Module designation	**Polymer Blends and Thermoplastic Elastomers** , MST10140
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Nguyễn Tường Vy; Nguyễn Tuấn An
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	lecture, exercise and seminar
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	• Thermodynamics of Materials • Polymer and Composite Materials. • Polymer Mechanical Properties • Polymer Processing Techniques
Module objectives/intended learning outcomes	Knowledge: Gain a solid foundational knowledge of the properties of different materials and the scientific principles that influence material behavior. Skills: Use and interpret results from data to make decisions about materials selection and fabrication.
Content	Chapter 1: Introduction to rubber and TPE materials (9 hours)

	Chapter 2: Thermodynamics of polymer and TPE blends (6 hours) Chapter 3: Compatibility and techniques for determining compatibility in polymer blends (6 hours) Chapter 4: Fabrication techniques of polymer and TPE blends (3 hours) Chapter 5: Mechanical properties of polymer and TPE blends (6 hours) Chapter 6 : Applications of polymer and TPE blends (3.5 hours) Chapter 7: Summary (4 hours)
Examination forms	Test, seminar, exercises
Study and examination requirements	• Minimum attendance of theory classes: 15 periods • Minimum attendance of practice classes: 15 periods • Other requirements: mandatory attendance of week 13.
Reading list	Polymer blends Handbook; Polymer blends

78. Mechanical Properties of Polymers

Module designation	**Mechanical Properties of Polymers**
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Hà Thúc Chí Nhân
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, Laboratory, Tutorial, Project-based learning
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hours Laboratory/Practical: 15 hours Tutorial/Project Guidance: 5 hours Self-study & Exam Preparation: 62.5 hours
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	Polymer and Composite Materials, Polymers Modification, Polymer Synthesis, Polymer Blends, Materials Fabrication 1 & 2, Materials Characterization 1 & 2
Module objectives/intended learning outcomes	Module objectives: The course will provide basic knowledge about the morphology, structure, and physical state of polymer materials, some basic principles of measuring methods of the mechanical properties of polymer materials. And also the course will give an intensive knowledge on the mechanical properties of polymer materials. On that basis, the students will be able to analyze more details about the relationship between structural morphology and mechanical properties of polymer materials, and these knowledges will help students understand - manipulate thoughtfully the physical methods of measuring polymer materials as well as identifying methods of suitable measuring of mechanical properties for different application areas of polymer products.

	And after the course, students can appropriately use polymer materials for many applications that require different kinds of mechanical properties when working for production factories. Or they can also use the knowledge to research, evaluate and explain the mechanical properties of new materials for their Master or PhD. studies. Upon successful completion of this module, students will be able to: 1. (Understand) Describe the relationship between polymer structure (molecular weight, crystallinity, Tg) and their mechanical properties. 2. (Apply) Apply standard testing methods (tensile, bending, impact, hardness, abrasion...) to characterize the mechanical behavior of polymer samples. 3. (Analyze) Analyze experimental data from mechanical tests to determine key parameters (Young's modulus, yield strength, toughness). 4. (Evaluate) Evaluate and select appropriate polymers for specific applications based on their mechanical property requirements and cost-effectiveness. 5. (Create) Design a basic test plan to solve a simple materials selection problem, considering mechanical performance and sustainability aspects.
Content	The module focuses on providing students with practical experience at businesses related to the field of Materials. The main topics include: 1. Structure-Property Relationships in Polymers. 2. Mechanical Behavior: Elastic, Plastic, and Viscoelastic Deformation. 3. Standard Test Methods: Tensile, Compression, Impact, Hardness, Creep, and Fatigue.

	4. Analysis of Stress-Strain Curves and Failure Mechanisms. 5. Polymer Selection for Engineering Applications and Sustainability. 6. Introduction to Advanced Characterization (e.g., DMA).
Examination forms	1. Midterm Examination (30%): Written test covering fundamental principles. 2. Laboratory Reports (30%): Reports for lab session 3. Final Project/Report (40%): A case study on selecting a polymer for a specific application, requiring justification based on mechanical properties and other factors.
Study and examination requirements	· Attend at least 80% of lectures and 100% of laboratory sessions. · Complete and submit all laboratory reports and the final project. · Achieve a minimum score of 4.0/10 for each assessment component and an overall mark of 5.0/10.
Reading list	*1. Core Textbooks:* *Ward, I. M., & Sweeney, J. Mechanical Properties of Solid Polymers. 3rd ed., Wiley, 2012.* *Callister, W. D., & Rethwisch, D. G. Materials Science and Engineering: An Introduction. 10th ed., Wiley, 2018.* *2. Reference Books:* *Shah, V. Handbook of Plastics Testing and Failure Analysis. 3rd ed., Wiley, 2007.* *3. Additional Resources:* *Relevant standards (ASTM, ISO) for polymer testing.* *Recent scientific articles on polymer mechanics from journals like Polymer, Journal of Applied Polymer Science.*

79. Polymer Processing Technology

Module designation	**Polymer Processing Technology, MSC10219**
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Hà Thúc Chí Nhân
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, Laboratory, Tutorial, Project-based learning
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 112.5 hours Lecture: 22.5 hours Laboratory/Practical: 15 hours Tutorial/Project Guidance: 5 hours Self-study & Exam Preparation: 62.5 hours
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	Polymer and Composite Materials, Polymers Modification, Polymer Synthesis, Polymer Blends, Materials Fabrication 1 & 2, Materials Characterization 1 & 2, Mechanical Properties of Polymers
Module objectives/intended learning outcomes	Module objectives: The course introduces the basic principles and methods for processing polymer materials. The course realates to the major engineering processes used to process polymer materials including techniques for mixing, extrusion, blown molding, compression molding, injection molding and thermo-forming. Characteristics, conditions of the process, equipment used and specifications are also mentioned. On that basis, students will have the knowledge to distinguish and use appropriate processing methods with each kind of polymer material that require different properties and applications when working in plastic industry.

	Provide basic knowledge of physical and chemical properties, applications and common processing methods to elaborate products of polymer materials. Based on these knowledge, the student can analyze the relationship between physical and chemical properties, applications and processing methods of polymer materials and apply correctly about the polymer processing methods in real plastic production field. Upon successful completion of this module, students will be able to: 1. (**Understand**) **Describe** the principles, advantages, limitations, and typical applications of major polymer processing methods (extrusion, injection molding, blow molding, etc.). 2. (**Apply**) **Select** appropriate processing parameters (temperature, pressure, screw speed) for a given polymer and product design. 3. (**Analyze**) **Analyze** the relationship between polymer structure, rheological properties, and its processability by different methods. 4. (**Evaluate**) **Identify** common defects in polymer products and **propose** corrective actions based on processing conditions. 5. (**Create**) **Design** a basic processing workflow for a simple polymer product, justifying the choice of method and material based on technical, economic, and sustainability criteria.
Content	The module focuses on providing students with practical experience at businesses related to the field of Polymer Materials. The main topics include: 1. Introduction to Polymer Processing: Rheology of polymer melts, thermal properties.

	2. Extrusion Processes: Single-screw extrusion, profile extrusion, blown film extrusion. 3. Molding Processes: Injection molding, blow molding, compression molding, thermoforming. 4. Mixing and Compounding: Principles and equipment. 5. Process-Property Relationships: How processing affects final product properties (crystallinity, orientation). 6. Quality Control and Defect Analysis in processing. 7. Sustainable and Advanced Processing: Energy efficiency, recycling, introduction to additive manufacturing for polymers.
Examination forms	1. Case Study Project and report (40%): Analyze a real-world product, recommend a processing method, and justify the selection. 2. Laboratory Reports (30%): Reports on practical sessions (e.g., setting up extrusion parameters, identifying defects). 3. Final Written Exam (30%): Focus on fundamental principles and application scenarios. |
Study and examination requirements	· Attend at least 80% of lectures and 100% of laboratory sessions. · Complete and submit all laboratory reports and the case study project. · Achieve a minimum score of 4.0/10 for each assessment component and an overall mark of 5.0/10.
Reading list	1. Core Textbooks: Osswald, T. A., & Hernández-Ortiz, J. P. *Polymer Processing: Modeling and Simulation*. Hanser Publishers, 2006. Strong, A. B. *Plastics: Materials and Processing*. 3rd ed., Pearson Prentice Hall, 2006.

	2. Reference Books: Rauwendaal, C. *Polymer Extrusion*. 5th ed., Hanser Publishers, 2014. 3. Additional Resources: ASTM/ISO Standards related to polymer processing and testing. Technical data sheets from major polymer producers (e.g., BASF, SABIC, DuPont). Journals: *Journal of Polymer Engineering, Polymer Engineering and Science*

80. Mechanical Polymers Laboratory

Module designation	**Mechanical Polymers Laboratory**, MSC10202
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Vu Tien Trung
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, Practice, Group discussion and Report
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 0 hour(s) Exercise: 0 hour(s) Laboratory: 60 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	4 ECTS
Required and recommended prerequisites for joining the module	- Polymer mechanical properties - Polymer and Composite Materials - Processing methods of polymer materials
Module objectives/intended learning outcomes	The goal of the course is to equip students with knowledge transformed from theoretical modules into practical applications, methods of processing and manufacturing polymer & polymer composite materials. Besides, students can use processing equipment skillfully, analyze mechanical properties based on the unique of materials and evaluate effective manufacturing through mechanical analysis of materials
Content	1st Week: Vulcanization of Natural Rubber, The internal mixer and mixing technology for making composite

	materials based on PP resin, Composite materials from glass fiber and thermosetting polymer (16 hours) 2nd Week: The practice of measuring polymer mechanics, analyze and reports (36 hours) 3th Week: Review knowledge and final examination (8 hours)
Examination forms	Experimental manipulation, Regular check points, Final examination
Study and examination requirements	Students must achieve a passing score and participate in all practical sessions
Reading list	1. Hoang ngoc Cuong, Mechanical properties of polymers, University Of Science Publishing House. 2. Nguyen Huu Tri, Natural Rubber Technology, Youth Publishing, 2004. 3. Andrew Ciesielski, An Introduction to rubber technology, Rapra technology LTD, 1999.

81. Polymer Synthesis Laboratory

Module designation	**Polymer Synthesis Laboratory**, MSC10201
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Nguyen Tuong Vy, Msc
Language	Vietnamese
Relation to curriculum	Elective, Polymer and Composite Materials Specialization
Teaching methods	lab work, lecture
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 0 hour(s) Exercise: 0 hour(s) Laboratory: 60 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	4 ECTS
Required and recommended prerequisites for joining the module	• Polymer and composite materials • Polymer material processing techniques • Material manufacturing methods • Rubber chemistry and technology.
Module objectives/intended learning outcomes	Knowledge: Demonstrate understanding of the structure-property-synthesis relationships of materials. Skills: Analyze experimental data, use tools and software to interpret results and draw meaningful conclusions about material properties. Attitude:

	Understand and adhere to ethical standards in research, including issues related to data integrity, intellectual property, and the social impact of new materials.
Content	Chapter 1: Emulsion Polymerization (10 hour) Chapter 2: Determination of viscosity average molecular weight of polyvinylancol (10 hours) Chapter 3: Synthesis of poly Phenol ureformandehide (10 hours) Chapter 4: Degradation of Natural Rubber Latex by H2O2 and Heat System (10 hours) Chapter 5: Synthesis of Polyvinyl Alcohol (10 hours) Chapter 6: Synthesis of foamed polyurethane (10 hours)
Examination forms	Report and test
Study and examination requirements	• Students must strictly comply with the rules and regulations of the Faculty, School and laboratory. . Students must complete 100% of the internship sessions to be eligible to take the final exam.
Reading list	Principles of polymer engineering, Engineering polymers

82. Biomedical Materials 2

Module designation	**Biomedical Materials 2** , MST10202
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Le Ngoc Ha Thu
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, seminar, final examination
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	Knowledge: Acquire an advanced knowledge of biomedical materials used in the treatment, rehabilitation and promotion of human health; Understand about the interaction between biomedical materials and living tissues, the clinical applications of biomedical materials, ophthalmology, orthopedics, cardiology, drug delivery materials, burn treatment materials... Explore fabrication methods and characterization techniques to evaluate the properties of some materials used in dentistry, drug delivery materials, and burn treatment materials;

	Apply knowledge and competences to optimize the process that manufactures biomedical materials and evaluating material properties with specific performance criteria. Skill: Develop critical thinking and innovative problem-solving skills. Communicate technical information effectively. Competences: Serious, on time, responsibly, obeying laboratory safety principles; Effective teamwork.
Content	Chapter 1. Interaction between biomaterials and living tissues Effects of implants on the host; biological environment impacts on materials. Chapter 2. Clinical applications of biomaterials Overview of medical and dental uses, implants, scaffolds, wound healing, and regenerative medicine. Chapter 3. Fabrication and characterization of biomaterials Dental biomaterials, drug delivery systems, burn treatment materials; techniques for evaluating physical, chemical, and biological properties. Chapter 4. In vivo monitoring and evaluation Biological responses to biomaterials, animal models, imaging techniques, and preclinical testing. At the end of the course, students will select topics for group seminars to develop deeper knowledge in specific areas
Examination forms	Attendance, Seminar, Final examination
Study and examination requirements	Attendance >70%, Score >70%
Reading list	Roger J. Narayan Editor, Biomedical Materials, Springer Nature Switzerland AG 2021; Roger J. Narayan, Monitoring and Evaluation of Biomaterials and their Performance In Vivo, Elsevier 2017.

83. Techniques for Evaluating the Biological Properties of Materials

Module designation	**Techniques for Evaluating the Biological Properties of Materials** , MST10204
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Hà Vân Linh
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, lesson.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	After completing this course, students will be able to explain the principles of flow cytometry, confocal laser scanning microscopy, real-time quantitative polymerase chain reaction (qPCR), enzyme-linked immunosorbent assay (ELISA). Furthermore, students will be able to apply these techniques to evaluate the cellular uptake, intracellular distribution, and immunostimulatory properties of materials.
Content	This course provides an introduction to techniques, labeling, imaging, gene expression testing, and their application to

	evaluate the behavior, properties, and performance of biomedical materials in performing their functions. Students explore the application of these techniques to in vitro evaluation of cellular uptake, intracellular distribution, and immunostimulatory properties of materials.
Examination forms	Mid-term Examination, Seminar and Final examination
Study and examination requirements	Attend class (>50% contact hours). Complete task performance (Seminar). Mid-term examination > 3 points (3/10) and Final examination > 4 points (4/10).
Reading list	Douglas W. Cromey (auth.), Douglas J. Taatjes, Jürgen Roth (eds.). Cell Imaging Techniques, Humana Press 2013. Richard P Haugland, Michelle T. Z Spence, Iain D Johnson, Aaron Basey. A Guide to Fluorescent Probes and Labeling Technologies. Life Technologies

84. Biological Property Assessment of Materials Internship

Module designation	**Biological Property Assessment of Materials Internship**, MSC10315
Semester(s) in which the module is taught	6th semester
Person responsible for the module	Hà Vân Linh
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	lab work, lesson.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 0 hour(s) Exercise: 0 hour(s) Laboratory: 60 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	4 ECTS
Required and recommended prerequisites for joining the module	Cell biology, molecular biology, and microbiology.
Module objectives/intended learning outcomes	Students are able to test gene expression at the transcriptional and translational levels, test cytotoxicity, antibacterial and antimicrobial properties of materials.
Content	The subject of Practical assessment of biological properties of materials equips students with skills to perform techniques including testing gene expression at the transcriptional and translational levels, testing cytotoxicity, antibacterial and bacteriostatic properties of materials, including materials

	manufactured in the subject of Practical assessment of biomedical materials manufacturing.
Examination forms	lab work practical assessment, attendance, procedure assessment.
Study and examination requirements	Attend class (100% contact hours). Final examination > 5 points (5/10).
Reading list	Douglas W. Cromey (auth.), Douglas J. Taatjes, Jürgen Roth (eds.). Cell Imaging Techniques, Humana Press 2013. Richard P Haugland, Michelle T. Z Spence, Iain D Johnson, Aaron Basey. A Guide to Fluorescent Probes and Labeling Technologies. Life Technologies

85. Optoelectronic Devices (updated)

Module designation	**Optoelectronic Devices** , MST10303
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Le Khac Top, PhD
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	lecture and seminar
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	Metal, semiconductor, and insulator materials
Module objectives/intended learning outcomes	2, 3, 4 Bloom level
Content	Chapter 1: General of semiconductor devices Chapter 2: Optical - Electrical properties of semiconductors Chapter 3: Optoelectronic devices Chapter 4: Opto-Electronic Conversion Devices Chapter 5: Photoelectrochemical Devices
Examination forms	Final exam, seminar, and discussion

Study and examination requirements	> 5/10 point
Reading list	Semiconductor Optoelectronic Devices, Semiconductors for Optoelectronics: Basics and Applications, Semiconductor Optoelectronic: Physics and Technology, Electronic and Optoelectronic Properties of Semiconductor Structures

86. Energy Harvesting and Conversion Materials

Module designation	**Energy Harvesting and Conversion Materials** , MST10402
Semester(s) in which the module is taught	7th semester
Person responsible for the module	Trần Duy Tập, Lê Khắc Tốp
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Lecture, Lesson, discussion on papers
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 30 hour(s) Exercise: 0 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	General objective: The general objective of the course is to provide learners with basic and advanced competencies in the application of advanced materials in energy harvesting and conversion. Specific objectives: Provide learners with basic and advanced skills to describe, present, explain, select, design, synthesize, or propose applications on issues related to advanced materials in energy harvesting and conversion. Learning outcomes: Describe and present the characteristics and requirements of advanced materials used in energy harvesting and conversion. Describe and present the

	operating principles of advanced materials in energy harvesting and conversion. Explain and evaluate factors affecting the performance and cost of advanced materials used in energy harvesting and conversion. Proficient in computer communication. Able to use foreign languages to carry out content and activities related to the subject. Interact and communicate effectively. Describe and evaluate the relevant content of advanced materials in chemical - physical properties for various applications in energy harvesting and conversion. Teamwork. Critical thinking.
Content	Chapter 1: Materials for the production, storage, conversion, and transportation of hydrogen energy. Chapter 2: Materials used in nuclear, wind and biomass energy. Chapter 3: Solar Energy Harvesting and Conversion Materials. Chapter 4: Materials for harvesting and converting thermal energy. Chapter 5: Piezoelectric Materials.
Examination forms	Seminar, Discussion, Attendance
Study and examination requirements	Total score greater than or equal to 5.
Reading list	Aliaksandr S. Bandarenka, Energy Materials A Short Introduction to Functional Materials for Energy Conversion and Storage, CRC Press Taylor & Francis Group, 2022. Kathy Lu, Materials in Energy Conversion, Harvesting, and Storage, Wiley, 2014. Gavin Conibe

87. Renewable Energy Harvesting and Conversion Technology

Module designation	**Renewable Energy Harvesting and Conversion Technology** , MST10404
Semester(s) in which the module is taught	8th semester
Person responsible for the module	Trần Duy Tập, Phạm Thanh Tuấn Anh
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Seminar
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 22.5 hour(s) Exercise: 15 hour(s) Laboratory: 0 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	3.25 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	General objective: The general objective of the course is to provide learners with basic and advanced competencies in renewable energy harvesting and conversion technologies. Specific objectives: Provide learners with basic and advanced skills to describe, present, explain, select, design, or propose applications on issues related to renewable energy harvesting and conversion technology. Learning outcomes. Describe and present the characteristics and components of energy harvesting and conversion technology systems. Describe and present the operating principles of energy

	harvesting and conversion technologies. Explain and evaluate factors affecting the performance, feasibility and economic efficiency of energy harvesting and conversion technologies. Proficient in computer communication. Able to use foreign languages to carry out content and activities related to the subject. Interact and communicate effectively. Describe and evaluate the relevant content of advanced materials in chemical - physical properties for various applications in energy harvesting and conversion. Teamwork. Critical thinking.
Content	Chapter 1: Hydrogen Energy Technology. Chapter 2: Nuclear Energy Technology. Chapter 3: Biomass Energy Technology. Chapter 4: Wind Energy Technology. Chapter 5: Solar Energy Technology. Chapter 6: Thermoelectric power generation technology.
Examination forms	Seminar
Study and examination requirements	Total score greater than or equal to 5
Reading list	D Bodansky, Nuclear energy: principles, practices, and prospects, Springer, 2007. DAJ Rand, R Dell, Hydrogen energy: challenges and prospects, RSC, 2008. B Wu, Y Lang, N Zargari, S Kouro, Power conversion and control of wind energy systems, Wiley, 2011. S

88. Characterization of Energy Conversion and Storage Devices

Module designation	**Characterization of Energy Conversion and Storage Devices**, MST10407
Semester(s) in which the module is taught	8th semester
Person responsible for the module	PGS.TS. Trần Duy Tập, TS. Tống Hoàng Tuấn, TS. La Phan Phương Hạ, TS. Lê Khắc Tốp, TS. Lê Thái Duy, TS. Phạm Thanh Tuấn Anh.
Language	Vietnamese
Relation to curriculum	Elective
Teaching methods	Discussion, Practice, Q&A
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 0 hour(s) Exercise: 0 hour(s) Laboratory: 60 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	4 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives/intended learning outcomes	General objective: To investigate and analyze the characteristics of laboratory-scale energy storage and conversion devices. Specific objectives: Survey and analyze the characteristics related to performance, efficiency, operating parameters and durability of fuel cells, supercapacitors, solar cells, thermoelectric batteries and some other devices. Students use knowledge about materials, energy, systems, equipment; skills in using survey and analysis methods for energy storage and conversion devices.

	Improve teamwork skills, practical skills, data processing skills, effective communication, critical thinking. Learning outcomes: Present and explain the operating principles of energy storage and conversion devices. Survey and analysis of data related to the characteristics of energy storage and conversion devices. Use laboratory scale energy storage and conversion devices. Process and analyze experimental data on the characteristics of energy storage and conversion devices. Evaluate factors affecting the efficiency, performance, and durability of energy storage and conversion equipment. Work independently and work effectively in a team. Effective communication in science.
Content	Lesson 1: Evaluation of solar cell conversion capacity. Lesson 2: Practice surveying the characteristic parameters of solar cells. Lesson 3: Evaluation of supercapacitor performance. Lesson 4: Survey of the capacity of thermoelectric components. Lesson 5: Survey of factors affecting fuel cell durability. Lesson 6: Survey of factors affecting fuel cell performance.
Examination forms	Oral presentation, essay, discussion, attendance.
Study and examination requirements	Total score greater than or equal to 5.
Reading list	Stephen Fonash, Solar Cell Device Physics, AP, 2009. Muhammad a Alam, M Ryyan Khan, Principles of Solar Cells Connecting Perspectives on Device, System, Reliability, and Data Science, WS, 2022. Hussain, Chaudhery Mustansar Newark, M. Basheer Ahamed, Smart

89. Graduation Thesis

Module designation	**Graduation Thesis** , MST10995
Semester(s) in which the module is taught	8th semester
Person responsible for the module	Hoang Thi Dong Quy, PhD
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Group/Individual discussion; Problem-based learning; Conduct and present in-progress laboratory experiments, statistical analysis and discussion; Present the research
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Lecture: 0 hour(s) Exercise: 0 hour(s) Laboratory: 300 hour(s) Private study including examination preparation, specified in hours: 1 lecture hour = 2.0 self-study hours 1 exercise (lab) hour = 1.0 self-study hour
Credit points	20 ECTS
Required and recommended prerequisites for joining the module	Specialized subjects
Module objectives/intended learning outcomes	Identify the research topic and understand all aspects of a research process, explore and experiment to gain broader understanding of the scientific subject; Design and execute a research project, analyze and discuss research findings, demonstrate analytical and problem solving skills; Describe the research, in written and oral forms, to advisor and thesis committee; Apply the basic knowledge to conduct in-depth research when working in manufacturing industry or research institutions for material fields; Identify/explain the principles

	of chemical safety/ the basic concepts, terms, tasks, and work ethics in polymer-composite materials science and technology
Content	Week 1: Discuss the research topic, equipment/technology/materials requirements; Week 2: Report research methodology, progress, and, factors that affect the quality of the research; Weeks 3-13: Conduct and present laboratory experiments/Analyze, interpret and report findings to thesis advisor; Week 14-15: Discuss and finalize the research topic Narrate the research process in the form of a formal thesis manuscript; Week 15: Present a scientific report
Examination forms	Oral presentation
Study and examination requirements	Evaluation of student performance Total = 30% (Committee) + 30% (Reviewer) + 40% (Advisor) ● Grade granted by the committee is the average of points given by all the members of the committee. • Strictly follow the rules and regulations of the Laboratory
Reading list	Paper/Research in International/National Journals/Books