**Vietnam National University – Ho Chi Minh City**

**University of Science**

**Faculty of Materials Science and Technology**

# MODULE HANDBOOK

Bachelor of Science in Materials Science

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## 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:<br>Lecture: 45 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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.<br>- Students apply knowledge about the worldview, MarxistLeninist philosophy, and philosophy creatively in cognitive<br>and practical activities, to solve problems that affect the social life of a country or of the time being set. |
| Content | Introduction (1 hours) |

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| | Chapter 1: Philosophy and its role in social life (15 hours)<br>Chapter 2: Dialectical Materialism (15 hours)<br>Chapter 3: Historical Materialism (14 hours) |
| Examination forms | - Presentation: 15%<br>- Midterm exam (essay): 20%<br>- Discussion: 15%<br>- Final exam (essay): 50% |
| Study and examination requirements | - Minimum attendance of lectures is about 80%<br>- Attend all reporting sessions, actively discuss, and submit all assignments |
| Reading list | 1. Ministry of Education and Training, 2009. Textbook of basic principles of Marxism-Leninism. National Political Publishing House.<br>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:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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. |

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| | - 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.<br>- 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)<br>Chapter 2: Commodities, markets and the role of market participants (6 hours)<br>Chapter 3: Surplus value in a market economy (7 hours)<br>Chapter 4: Competition and Monopoly in a Market Economy (5 hours)<br>Chapter 5: Socialist-oriented market economy and economic interests in Vietnam (5 hours)<br>Chapter 6: Vietnam's industrialization, modernization and international economic integration (5 hours) |
| Examination forms | - Presentation: 15%<br>- Midterm exam (essay): 20%<br>- Discussion: 15%<br>- End semester exam (essay): 50% |
| Study and examination requirements | - Minimum attendance of lectures is about 80%.<br>- 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:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 Marxism Leninism).<br>- 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)<br>Chapter 1: Introduction to Scientific Socialism (3 hours) |

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| | Chapter2: The historical mission of the working class (3 hours)<br>Chapter 3: Socialism and the transition to socialism (5 hours)<br>Chapter 4: Socialist democracy and the socialist state (5 hours)<br>Chapter 5: Class social structure and class and class alliances in the transition to socialism (5 hours)<br>Chapter 6: Ethnic and religious issues in the transition to socialism (3 hours)<br>Chapter 7: The problem of the family during the transition to socialism (3 hours) |
| Examination forms | - Presentation: 15%<br>- Midterm exam (essay): 20%<br>- Discussion: 15%<br>- End semester exam (essay): 50% |
| Study and examination requirements | - Minimum attendance of lectures is about 80%.<br>- Attend all presentations, actively discuss, submit all assignments. |
| Reading list | 1. Ministry of Education and Training, 2021. Scientific Socialism Curriculum. National Political Publishing House.<br>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:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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). |

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| | - 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.<br>- 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)<br>Chapter 1: The Communist Party of Vietnam was born and led the struggle for power (1930-1945) (12 hours)<br>Chapter 2: The Party led two resistance wars, completed national liberation and reunification (1945-1975) (6 hours)<br>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%<br>- Midterm exam (essay): 20%<br>- Discussion: 15%<br>- Final exam (essay): 50% |
| Study and examination requirements | - Minimum attendance of lectures is about 80%.<br>- 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:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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.<br>- Students are able to think, analyse, evaluate, and creatively apply Ho Chi Minh's Thoughts to solve problems in real life, study and work.<br>- Students are able to improve their political bravery, patriotism, loyalty to the goal, the ideal of national |

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| | 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%<br>- Midterm exam (essay): 20%<br>- Discussion: 15%<br>- End semester exam (essay): 50% |
| Study and examination requirements | - Minimum attendance of lectures is about 80%.<br>- 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:<br>Lecture: 45 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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.<br>Specific objectives/course output standards: |

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| | - 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;<br>- Analysing legal regulations; lookup legal documents; teamwork<br>- 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)<br>Chapter 2: State apparatus (8 hours)<br>Chapter 3: Law - A tool to regulate legal relations (8 hours)<br>Chapter 4: Laws in the legal system (16 hours)<br>Chapter 5: General issues on anti-corruption (4 hours)<br>Revision (1 hour) |
| Examination forms | - Progress Test: 10%,<br>- Discussion, exercise, practice: 10%<br>- Attendance: 10%<br>- Mid term test (multiple choice): 20%<br>- Final exam (multiple choice): 50% |
| Study and examination requirements | - Minimum attendance of lectures is about 80%.<br>- 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:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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<br>- Students have the ability to apply the knowledge learned to study the nature of economic phenomena, the laws, and |

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| | trends of the phenomena, and the laws of the market economy.<br>- Students have the ability to apply the knowledge learned in the study of macroeconomics, development economics, and several other economic subjects.<br>- 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.<br>- Students have the ability to develop reasoning and public speaking skills.<br>- 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.<br>- 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 self assessment capacity; develop public speaking and commenting skills. |
| Content | Chapter 1: Introduction (2 hours)<br>Chapter 2: Supply, demand, and market prices (8 hours)<br>Chapter 3: Consumer behaviour (6 periods)<br>Chapter 4: Producer theory (6 periods)<br>Chapter 5: Measuring national output, aggregate supply, aggregate demand (8 hours) |
| Examination forms | - Homework (exercise): 20%<br>- Midterm exam (multiple choice): 20%<br>- 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. |

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| | 2. Ministry of Education and Training, 2013. Microeconomics, Vietnam Education Publishing House |

## 8. General Psychology

| **Module designation** | **General Psychology** , BAA00006 |
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| 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:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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.<br>- Students have the ability to identify human psychological states. |

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| | - Students have the ability to understand the psychological attributes that make up the personality structure; the factors affecting the formation and development of personality.<br>- Students have the ability to form and develop the ability to identify psychological phenomena, and apply learned knowledge to solve practical problems.<br>- 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.<br>- 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.<br>- Students have the ability to practise reasoning skills; public speaking skills; form and develop teamwork skills. |
| Content | Chapter 1: General overview of psychology<br>Chapter 2: Objects, tasks and research methods<br>Chapter 3: Natural and social basis of formation and psychology, consciousness<br>Chapter 4: The process of sensory perception<br>Chapter 5: The process of rational perception<br>Chapter 6: Memory and Attention<br>Chapter 7: Emotions and feelings<br>Chapter 8: Willpower<br>Chapter 9: Personality |
| Examination forms | - Exercise (2 individual exercises + 2 group exercises): 30%;<br>- Mid term test (multiple choice): 20%<br>- Final exam (essay): 50% |
| Study and examination requirements | Minimum attendance of lectures is about 80%, active in discussion, and submit all exercises on time. |

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| Reading list | 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:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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.<br>- Students are able to detect available reserves in the system, especially those that are free to use.<br>- Students are able to solve the inconsistencies in the problem. |

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| | - Students are able to provide and select appropriate approaches to solve the problem.<br>- Students are able to develop ideas for system improvement.<br>- Students are able to forecasting the development trend of the system in the future<br>- Students are able to detect, place, and select the problem to be solved.<br>- Students are able to improve themselves; build a scientific and creative thinking and working style.<br>- Students are able to be systematic and dialectically |
| Content | The introduction chapter (2 hours)<br>Chapter 1: Natural methods of problem-solving and decision making (2 hours)<br>Chapter 2: Some scientific and technical knowledge is the basis of the subject (12 hours)<br>Chapter 3: Some basic creative tricks (principles) (12 hours)<br>Chapter 4: Methods of activating creative thinking (6 hours)<br>Chapter 5: Rules of system development (10 hours)<br>Summary (1 hours) |
| Examination forms | - Exercise: 20%<br>- Mid term test (essay): 30%<br>- 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. Academic and Professional Skills

| **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:<br>Lecture: 22.5 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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:<br>- Goal Setting and Planning<br>Understand how to define goals, prioritize objectives, manage tasks, and develop effective plans for study and work.<br>- Communication Skills<br>Learn key communication techniques applicable in both academic and professional environments, including verbal communication, non-verbal cues |

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| | (body language), active listening, academic and professional writing, effective questioning, and constructive feedback.<br>- Presentation Skills<br>Master the process of effective presentations—from preparation and content development to delivery and handling unexpected situations confidently.<br>- Teamwork<br>Understand the dynamics of team-based work and develop skills for effective collaboration, role distribution, and conflict resolution within groups.<br>- Problem Solving and Critical Thinking<br>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.<br>- Professionalism<br>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<br>□ Teamwork Skills<br>□ Problem solved Skills<br>□ Time Management and Planning Skills<br>□ Effective Communication Skills<br>□ Conflict Resolution Skills<br>□ Become Global Citizen Skills<br>□ 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 |

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

## 11. 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 | Elective |
| Teaching methods | Lecture, labwork |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 22.5 hour(s)<br>Practice: 15 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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:<br>1. Work safely in the Laboratory of Physics, Chemistry and Biology with an understanding of safety regulations.<br>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<br>2. Safety in Chemistry Laboratory<br>3. Safety in Physics Laboratory |

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| | 4. Safety in Biology Laboratory<br>5. Emergency and reactions |
| Examination forms | Oral presentation (15%)<br>Midterm exam (15%)<br>Class assignment (30%)<br>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<br>2. Samuel Kotz, Xizhi Wu, Norman L Johnson, Inspection errors for attributes in quality control, 1991, Chapman and Hall |

## 12. 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 | Lectures, discussion |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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:<br>- 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.<br>- Skills:observing natural processes on earth.<br>- Competences: to improve personal skills, attitudes and communication skills. |
| Content | - Earth in the universe |

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| | - Structure and material of the Earth.<br>- The internal and external geological processes<br>- The atmostphere and the hydrosphere of the Earth.<br>- Human and the earth. |
| Examination forms | - Assignments: 20%<br>- Mid-term examination: 30%<br>- 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.<br>2. Luu Duc Hai, Tran Nghi (2008). Earth science.<br>3. Edward J. Tarbuck, Frederick K. Lutgens (2012). Earth Science. |

## 13. 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 | Elective |
| Teaching methods | Lecture, group work, exercise |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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<br>- Describe the basic components of the natural environment<br>- Presentation of the environmental issues in the world and in Vietnam<br>- Impacts due to socio-economic activities on the environment<br>- Presentation of basic solutions to protect the environment, conserve resources and sustainable development. |
| Content | Theory and exercise: 45 periods = 37.5 hours |

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| | Chapter 1. Introduction of module (3 periods)<br>Chapter 2. Basic components of the environment (6 periods)<br>Chapter 3. Ecosystems and the application of ecological principles to the environment (6 periods)<br>Chapter 4. Main types of ecosystems (6 periods)<br>Chapter 5. Natural resources (3 periods)<br>Chapter 6. Environmental pollution (6 periods)<br>Chapter 7. Global climate change and environmental protection strategies (3 periods)<br>Chapter 8. Population and environment (3 periods)<br>Chapter 9. Environmental Management (3 periods)<br>Chapter 10. Sustainable development and environmental protection (6 periods)<br>Self study: 90 hours |
| Examination forms | Exercise (reports): 50 %;<br>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.<br>2. Goudie, A. The Human Impact on Natural Environment.<br>6th Edition. Oxford, Blackwell, 2006. |

## 14. 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<br>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:<br>Lecture: 30 hour(s)<br>Exercise: 30 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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<br>- Describe the electronic structure of atoms according to the modern atomic model<br>- 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 |

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| | bonds, and use these theories to explain and predict the fundamental properties of chemical substances.<br>- Differentiate the strengths, weaknesses, and application scopes of the aforementioned basic bonding theories.<br>- Utilize models of gases, liquids, and solids to explain and predict the fundamental properties of gases, liquids, and the primary types of crystal structures.<br>- 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<br>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<br>Chapter 3. The periodic table and periodic law<br>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<br>Chapter 5. Gaseous state – Gas laws<br>Chapter 6. Liquid state – Intermolecular forces; Structure and properties of solids<br>Chapter 7. Solutions |
| Examination forms | - Midterm examination (writing test): 25%<br>- Exercise (tests): 15 %<br>- Attendance (quizz): 10%<br>- Final examination (writing test): 50 % |

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| 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 |

## 15. 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:<br>Lecture: 30 hour(s)<br>Exercise: 30 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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.<br>Determine the conditions under which reactions occur spontaneously and achieve chemical equilibrium.<br>Analyze and calculate the factors affecting chemical equilibrium.<br>Establish rate expressions and calculate the factors influencing reaction rates.<br>Identify various types of equilibria in solutions and calculate the pH of solutions. |

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| | 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:<br>Chapter 1: Chemical Thermodynamics – Energy Exchange and Chemical Transformations (8 periods)<br>Chapter 2: Thermodynamics – Entropy, Free Gibbs Energy, and Spontaneity of Chemical Reactions (4 periods)<br>Chapter 3: Chemical Kinetics – Reaction Rate and Mechanism (6 periods)<br>Chapter 4: Chemical Equilibrium (6 periods)<br>Chapter 5: Acid–Base Equilibria and Ionic Equilibria in Solution (10 periods)<br>Chapter 6: Electrochemistry (6 periods) |
| Examination forms | - Midterm examination (writing test): 30%<br>- Exercise (Quizz, in-class works): 15 %<br>- 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. |

## 16. 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:<br>Lecture: 0 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 60 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 4 ECTS |
| Required and recommended prerequisites for joining the module | General Chemistry 1 |
| 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: |

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| | (1) Uses of equipment in the chemistry laboratory: How to use and record the data obtained.<br>(2) Using a titration device, applicable to the titration of table vinegar<br>(3) Acidic and basic properties of solutions<br>(4) Determine the molar mass of a volatile liquid<br>(5) Chemical Equilibrium Survey<br>(6) Determination of thermodynamic parameters of Borax dissolution process<br>(7) Determine the order of the reaction<br>(8) Determination of electrode potential |
| Examination forms | Experiments + lab report |
| 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.<br>[2] Võ Duy Thanh, Võ Văn Bé (2009). Bài tường trình thực tập Hóa đại cương A. Tp HCM: ĐHQG Tp HCM. |

## 17. Fundamental of Materials Science

| **Module designation** | **Fundamental of Materials Science**, MSC00001 |
|---|---|
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | Trần Thị Thanh Vân, Trần Thị Như Hoa, Lê Khắc Tốp, Huỳnh Nguyễn Thanh Luận |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | lecture slides & videos, Students do homework assignments, Q&A and discussion |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 22.5 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 3.25 ETCS |
| 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, diffusion mechanisms, and their effects on material properties and applications in science, technology, and daily life<br>+ Have the skills to self-study, search, exploit, process and apply information about knowledge related to the subject<br>+ Have the skills to work in groups. |

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| | + Identify areas of specialization and potential research directions in materials science and technology. |
| Content | Chapter 1: Introduction to Atomic Structure and Bonding (Weeks 1–2)<br>Lesson 1.1: Atomic Structure, Types of Atomic and Molecular Bonds<br>Lesson 1.2: Bonding and Material Properties<br>Chapter 2: Atomic Order in Solids (Weeks 3-5)<br>Lesson 2.1: Crystal Structure, Crystallographic Directions and Planes<br>Lesson 2.2: Types of Solid-State Crystal Structures, Single Crystals, and Polycrystals<br>Chapter 3: Defects in Solid Materials (Weeks 6-7)<br>Lesson 3.1: Properties of Defects<br>Lesson 3.2: Classification of Defects and Applications<br>Chapter 4: Diffusion (Weeks 8-9)<br>Lesson 4.1: Diffusion and Diffusion Mechanisms<br>Lesson 4.2: Steady-State and Non-Steady-State Diffusion and Applications<br>Chapter 5: Selected Properties of Materials and Applications (Mechanical, Thermal, Optical, Electrical, Magnetic, Biological) (Weeks 10) |
| Examination forms | Midterm Exam : 30%<br>Regular/Continuous Assessment (hoặc Quizzes & Assignments) : 5%<br>Attendance & Participation : 5%<br>Final Exam: 60% |
| Study and examination requirements | • Students are not allowed to be absent for more than 10% of total class sessions.<br>• Students submit complete assignments and look up lectures and materials at home<br>• Total score must be over or at least equal to 5 |
| Reading list | 1. Materials Science and Engineering: An Introduction by William D. Callister Jr., David G. Rethwisch (2010). ISBN 10: 0470419970, John Wiley & Sons. Inc. |

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| | 2. Engineering Materials: Properties and Selection by Kenneth G. Budinski (1996), ISBN-10: 013367715X, Prentice Hall International, New Jersey<br>3. Vật liệu Đại cương của Trần Thế San (2013), Nhà xuất bản ĐHQG-HCM. |

## 18. 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<br>Dr. Tran Thi Nhu Hoa<br>Dr. Le Khac Top<br>MSc. Huynh Nguyen Thanh Luan<br>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:<br>Laboratory: 60 hours<br>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:<br>**Knowledge**<br>Identify and classify fundamental types of materials (metals, ceramics, polymers, composites) based on their structures and properties.<br>Explain the relationship between atomic structure, microstructure, defects, and material properties through laboratory experiments.<br>Understand the influence of external factors such as temperature, mechanical stress, and environment on the |

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

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| | Lesson 5: Investigation of the Effect of Defects on the Electrical Properties of Materials (week 8)<br><br>Lesson 6: Investigation of the Optical Properties of Materials (week 9)<br><br>Lesson 7: Investigation of the Effect of Temperature on Diffusion Processes (week 10) |
| Examination forms | · Continuous assessment (60%):<br><br>● Laboratory performance and attendance (10%)<br>● Laboratory reports (30%)<br>● Group discussions and presentations (20%)<br><br>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.<br><br>+ Handbook for Laboratory Safety, Sveinbjornsson, B. (Ed.). Academic Press, 2015.<br><br>+ William D. Callister, Materials Science and Engineering: An Introduction, 10th ed., John Wiley & Sons, 2018.<br><br>+ Kenneth G. Budinski, Engineering Materials: Properties and Selection, Prentice Hall, 1996.<br><br>+ Tran The San, General Materials Science (in Vietnamese), VNU-HCM Press, 2013. |

## 19. Introduction to Materials Science

| **Module designation** | **Introduction to Materials Science**, MSC00010 |
|---|---|
| Semester(s) in which the module is taught | 1st semester |
| Person responsible for the module | Ha Thuc Chi Nhan |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lecture, brainstorming, interrogation, group discussion |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 15 hour(s)<br>Exercise: 30 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 | After finishing this course, students are able to:<br>Summarize the role of the field of materials science in economics, society, and science and technology.<br>Integrate the relationship between materials science and other scientific and engineering disciplines.<br>Summarize the overarching objectives of the materials science training program.<br>Apply skills in finding resources, group learning, using the library, time management for studying, extracurricular activities, and social engagement. |

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| | Adopt a positive attitude toward the field, fostering an active learning orientation. |
| Content | Chapter 1: Overview of the Field of Materials Science<br>Lesson 1.1: General introduction to the training program in Materials Science and Technology<br>Lesson 1.2: General objectives of the Materials Science and Technology program compared to related training fields<br>Lesson 1.3: Comparison of the Materials Science curriculum at the University of Science, VNU-HCM, with domestic and international training programs<br>Chapter 2: Learning Methods in Higher Education<br>Lesson 2.1: Differences in training objectives between high school and university<br>Lesson 2.2: Current higher education environment and active learning methods at the university level<br>Chapter 3: The Importance of Fundamental Sciences to the Future Development of Materials Science in Vietnam and Worldwide<br>Lesson 3.1: The importance of natural sciences<br>Lesson 3.2: The importance of engineering and technology courses<br>Chapter 4: Career Opportunities and Postgraduate Studies in Materials Science<br>Lesson 4.1: Job opportunities in production, business, and service sectors within the Materials Science field<br>Lesson 4.2: Postgraduate study opportunities in Materials Science<br>Chapter 5: Methods for Searching, Managing, and Using Reference Materials<br>Lesson 5.1: Methods for searching study and research materials<br>Lesson 5.2: Methods for managing and utilizing reference materials<br>Review Session |

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| Examination forms | Progressing tests: 60%<br>Final exam: 40% |
| Study and examination requirements | The minimum attendance of lectures is about 80% |
| Reading list | 1. Callister, W. D. (2010). Materials Science and Engineering: An Introduction (7th ed.). John Wiley & Sons, Inc.<br>2. Trần Thế San. (2013). Vật liệu Đại cương [General Materials]. NXB ĐHQG TP.HCM [Vietnam National University Press, Ho Chi Minh City]. |

## 20. General Biology 1

| **Module designation** | **General Biology 1**, BIO00001 |
|---|---|
| Semester(s) in which the module is taught | 1st semester |
| Person responsible for the module | Ha Van Linh, Msc |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lecture, brainstorming, interrogation, group discussion |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 45 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 concepts of biology.<br>- Students are able to explain biological systems.<br>- Students are able to distinguish the method of sterilization of biomedical implants<br>- Students are able to understand the cell-biomaterial interactions.<br>- Students are able to know drug delivery systems<br>- Students are able to understand the concepts of tissue engineering |

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| Content | Chapter 1: Biological systems (10 hours)<br><br>1.1 The biological environment<br>1.2 Genetic regulation and control systems<br>1.3 The plasma membrane<br>1.4 Cytoskeleton and motility<br>1.5 Cell-to-cell communication pathways<br>1.6 Cell junctions<br><br>Chapter 2: Sterilization of biomedical implants (6 hours)<br>2.1 Common terminology<br>2.2 Steam sterilization<br>2.3 Ethylene oxide sterilization<br>2.4 Gamma radiation sterilization<br>2.5 Other sterilization methods<br>2.6 Recently developed method<br><br>Chapter 3: Cell–biomaterial interactions (8 hours)<br><br>3.1 The extracellular environment<br>3.2 Extracellular matrix mimics<br>3.3 Cell interactions with non-cellular substrates<br><br>Chapter 4: Drug delivery systems (9 hours)<br>4.1 Diffusion controlled drug delivery systems<br>4.2 Water penetration controlled drug delivery systems<br>4.3 Chemically controlled drug delivery systems<br>4.4 Responsive drug delivery systems<br>4.5 Particulate system<br><br>Chapter 5. Tissue engineering (12 hours)<br>Tissue engineering approaches<br>Cells<br>Scaffold properties<br>Polymeric scaffolds and natural polymer scaffolds<br>Cell seeded scaffolds<br>Cellular properties and Tissue properties<br>Challenges in tissue engineering |
| Examination forms | - Attendance: 5%<br><br>- Regular exercise: 25%<br><br>- Mid term test (multiple choice): 20%<br><br>- Final exam (multiple choice): 50% |
| Study and examination requirements | The minimum attendance of lectures is about 80% |

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| Reading list | 1. Roger Narayan, 2009. Biomedical Materials. Springer Science+Business Media.<br>2. C. Mauli Agrawal, Joo L. Ong, Mark R. Appleford, Gopinath Mani, 2014. Introduction to Biomaterials, Cambridge University Press. |

## 21. 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:<br>Lecture: 45 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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.<br>- Students have the general knowledge about the field of differential and integral calculus of functions of one variable.<br>- 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.<br>- Students are able to apply each subject in the course and will be integrated into the lectures so that students can |

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| | understand the mathematical basis of a number of problems in their majors.<br>- 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)<br>Chapter 2: Functions of one variable - limits, and continuity of functions of one variable. (9 hours)<br>Chapter 3: Differential calculus of functions of one variable. (9 hours)<br>Chapter 4: Integral calculus functions of one variable. (9 hours)<br>Chapter 5: Differential equations. (9 hours) |
| Examination forms | - Attendance: 5%<br>- Exercise : 15%<br>- Mid-term test (essay): 30%<br>- 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.<br>2. James Stewart, 2008. Calculus, early transcendental, 7 edition. Brooks Cole. |

## 22. 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:<br>Lecture: 45 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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.<br>- 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 |

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| | 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.<br>- 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)<br>1.1 Matrix and matrix transformations.<br>1.2 Rank of matrix and inverse matrix<br>1.3 Determinants<br>1.4 System of linear equations<br>Chapter 2: Calculus of functions of many variables (30 hours)<br>2.1. Function of two variables<br>2.2 Polar coordinate system<br>2.3 Limits of the functions of two variables<br>2.4 Partial derivatives - Directional derivatives<br>2.5 Differential and integral calculus of multivariable functions<br>2.6 Hidden-variable theorems |
| Examination forms | - Exercise: 20%<br>- Attendance: 5%<br>- Mid-term test (essay): 25%<br>- 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. |

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| | 2. James Stewart, 2008. Calculus, early transcendental, 7 edition. Brooks Cole. |

## 23. Probability and Statistics

| **Module designation** | **Probability and Statistics** , MTH00040 |
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| 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:<br>Lecture: 45 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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.<br>- Students have the ability to employ probability and statistics to solve some real-world problems related to analysis and presentation of data.<br>- 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 |

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| | science can be formed, then a serious and proactive attitude in study. |
| Content | Chapter 1: Combinatorics (2 hours)<br>Chapter 2: Probability Basics (9 hours)<br>Chapter 3: Random Variables (14 hours)<br>Chapter 4: Descriptive Statistics (7 hours)<br>Chapter 5: Hypothesis testing (9 hours)<br>Chapter 6: Regression and correlation (4 hours) |
| Examination forms | - Attendance: 10%<br>- Exercise: 10%<br>- Midterm test (multiple choice): 20%<br>- 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. |

## 24. 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:<br>Lecture: 45 hour(s)<br>Exercise: 22.5 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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<br>be achieved the following:<br>- 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. |

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| | - Students are able to work at individual level and group work.<br>- Students have the ability to apply mechanics and thermodynamics knowledge to analyse physical situations. |
| Content | Chapter 1:Physics and measurement (1hour)<br>Chapter 2: Kinematics of particles (6 hours)<br>Chapter 3: Force and Newton's laws (8 hours)<br>Chapter 4: Conservation laws in classical mechanics (6 hours)<br>Chapter 5: Kinetics of rigid bodies (8 hours)<br>Chapter 6: The ideal gas (3 hours)<br>Chapter 7: The first law of thermodynamics (7 hours)<br>Chapter 8: The second law of thermodynamics (6 hours) |
| Examination forms | - Exercise: 20%<br>- Attendance: 5%<br>- Midterm test (essay): 25%<br>- 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.<br>2.Nguyen Thanh Van, 2013. General physics (Mechanics and heat). Ho Chi Minh City National University Publishing House |

## 25. 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 | Cao Thị Mỹ Dung, Đặng Vinh Quang |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | lecture, lesson, brainstorming |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 45 hour(s)<br>Exercise: 22.5 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 6 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<br>Chapter 2. Conductors 4 hours<br>Chapter 3. Constant current 4 hours |

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| | Chapter 4. Magnetostatics 7 hours<br>Chapter 5. Electromagnetic induction 4 hours<br>Chapter 6. Electromagnetic waves 4 hours<br>Chapter 7. Interference of Light Waves 5 hours<br>Chapter 8. Diffraction of Light Waves 5 hours<br>Chapter 9. Polarization of Light Waves 5 hours |
| Examination forms | Homework: 20%<br>Midterm exam: 30%<br>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<br>2. Fundamentals of Physics, by David Halliday, Wiley, 2014 |

## 26. 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:<br>Lecture: 0 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 60 hour(s)<br>Preparation and followup: 60 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 1 self-study hour<br>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:<br>- 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 |

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

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

## 27. 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:<br>Lecture: 30 hour(s)<br>Exercise: 30 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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,<br>-Students have basic and foundational knowledge of modern physics related to quantum physics, atomic physics, and nuclear physics<br>- students have scientific discussion skills in the classroom and critical thinking.<br>- 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 |

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

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| 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<br>2. Lương Duyên Bình, Ngô Phú An, Lê Băng Sương, Nguyễn Hữu Tăng, Vật lý đại cương (Tập 3), NXB Giáo Dục, 2003 |

## 28. 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:<br>Lecture: 15 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 60 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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<br>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:<br>- Students have the ability to working with common software on computers<br>- Students have the ability to prepare text. presentation and data calculation with calculators<br>- Students can build electronic information pages. |

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

## 29. 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:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 30 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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:<br>- 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. |

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| | - 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.<br>- Students have the ability to pronounce single words, word clusters and sentences, describe a given picture, and build basic communications in daily life.<br>- Students have the ability to comprehend 300-500 word passages of familiar topics, and gain more knowledge of different cultures around the world<br>- Students have the ability to write essays about familiar topics related to daily life, learning activities,<br>entertainment, events. |
| Content | Module 1: Leisure and lifestyle (6 hours)<br>Module 2: Important firsts (6 hours)<br>Module 3: At rest, at work(6 hours)<br>Module 4: Special occasions(6 hours)<br>Module 5: Appearance (6 hours)<br>Module 6: Time off (6 hours)<br>Module 7: Ambitious dreams (6 hours)<br>Module 8: Countries and cultures (6 hours)<br>Review - speaking test ( 12 hours) |
| Examination forms | - Attendance: 10%<br>- Regular exercise: 10%<br>- Mid-term test (multiple choice): 30%<br>- 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. |

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| | 2. Sarah Cunningham, Peter Moor, Jane Cornyns Carr, 2005. New Cutting Edge, Pre-intermediate: workbook. Harlow: Pearso |

## 30. 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:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 30 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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:<br>- 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. |

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| | - Students have the ability to choose the correct response for the questions, and understand dialogues and short monologues.<br>- 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.<br>- Students have the ability to comprehend 500-700 word passages of familiar topics, and gain more knowledge of different cultures around the world.<br>- 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)<br>Module 2: Take care! (8 hours))<br>Module 3: The best thing in life (8 hours)<br>Module 4: Got to have it! (8 hours)<br>Module 5: Choosing the right person (8 hours)<br>Module 6: Money, Money, Money (8 hours)<br>Module 7: Imagine (8 hours)<br>Review (4 hours) |
| Examination forms | - Attendance: 10%<br>- Regular exercise: 10%<br>- Mid-term test (multiple choice): 30%<br>- 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.<br>2. Sarah Cunningham, Peter Moor, Jane Cornyns Carr, 2005. New Cutting Edge, Pre-intermediate: workbook. Harlow: Pearso |

## 31. 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:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 30 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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:<br>- 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.<br>- Students can understand and use new language in a natural, communicative way. |

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| | - Students have the ability to present their opinions about some social and cultural issues and understand dialogues and talks.<br>- Students have the ability to comprehend 500-700 word passages of familiar topics, and gain more knowledge of different cultures around the world.<br>- 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)<br>Module 2: Memory (8 hours)<br>Module 3: Around the world (8 hours)<br>Module 4: Life stories (8 hours)<br>Review module 1 to 4, practice speaking (8 hours)<br>Module 5: Success (8 hours)<br>Module 6: In the media (8 hours)<br>Review (4 hours) |
| Examination forms | - Attendance: 10%<br>- Regular exercise: 10%<br>- Mid-term test (multiple choice): 30%<br>- 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.<br>2. Sarah Cunningham, Peter Moor, Jane Cornyns Carr, 2005. New Cutting Edge, Pre-intermediate: workbook. Harlow: Pearso |

## 32. 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:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 30 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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:<br>- Students have the ability to understand and use the language needed in more complex real-life situations in a natural, communicative way<br>- Students have the ability to express their own ideas in interviews, mini-talks, problem-solving and storytelling |

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| | - 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<br>- 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)<br>Module 2: Things you can't live without (8 hours)<br>Module 3: Future society (8 hours)<br>Module 4: An amazing story (8 hours)<br>Review module 1 to 4, practice speaking (8 hours)<br>Module 5: Rules and freedom (8 hours)<br>Module 6: Dilemmas (8 hours)<br>Revision of grammar (4 hours) |
| Examination forms | - Attendance: 10%<br>- Regular exercise: 10%<br>- Mid-term test (multiple choice): 30%<br>- 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.<br>2. Sarah Cunningham, Peter Moor, Jane Cornyns Carr, 2005. New Cutting Edge, Pre-intermediate: workbook. Harlow: Pearso |

## 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<br>Method of completion and division<br>Training method: repetition, change of content, game, competition....<br>Method of correcting wrong movements. |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 15 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 30 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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<br>- Having knowledge about injury prevention and birth in sports training and competition. Knowledge of types of physical exercises to improve health and develop physical |

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| | fitness groups in accordance with the development of the organism: knowledge of planning and regular exercise method.<br>- 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.<br>- 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:<br>● Football 1<br>● Volleyball 1<br>● Basketball 1<br>● Table tennis 1<br>● Tennis 1<br>● Badminton 1<br>● Martial Arts 1<br>● Aerobic 1<br>● Swimming 1<br>● 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)<br>- 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. |

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| Reading list | 1. Luu Quang Hiep, Le Duc Chuong, Vu Chung Thuy, Le Huu Hung (2000), Sports Medicine, Sports Publishing House, Hanoi.<br>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<br>Method of completion and division<br>Training method: repetition, change of content, game, competition....<br>Method of correcting wrong movements. |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 15 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 30 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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.<br>- Having knowledge about injury prevention and birth in sports training and competition. Knowledge of types of physical exercises to improve health and develop physical |

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| | fitness groups in accordance with the development of the organism: knowledge of planning and regular exercise method.<br>- Knowledge of development history, rules, organization of competition and refereeing number of sports learned.<br>Mastering technical principles, tactics, contents, methods and forms of organizing sports practice in the training program.<br>- 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:<br>● Football 2<br>● Volleyball 2<br>● Basketball 2<br>● Table tennis 2<br>● Tennis 2<br>● Badminton 2<br>● Martial Arts 2<br>● Aerobic 2<br>● Swimming 2<br>● 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)<br>- 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 |

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| Reading list | 1. Luu Quang Hiep, Le Duc Chuong, Vu Chung Thuy, Le Huu Hung (2000), Sports Medicine, Sports Publishing House, Hanoi.<br>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 |
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| 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:<br>Lecture: 0 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 120 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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; |

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| | Know how to prevent enemy fire attacks with high-tech weapons.<br>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<br>1. Subjects, tasks, research methods of the subject<br>2. Basic views of Marxism-Leninism, Ho Chi Minh's ideology on war, army and national defense<br>3. Building national defense and people's security to protect the socialist Vietnamese nation.<br>4. People's War to protect the Socialist Fatherland of Vietnam<br>5. Building the people's armed forces<br>6. Combine economic and social development with strengthening national defense, security, and foreign affairs.<br>7. Basic issues about the history of Vietnamese military art<br>8. Building and protecting sovereignty over seas, islands, and national borders in the new situation<br>9. Building militia and self-defense forces, reserve forces and national defense mobilization<br>10. Building a movement of all people to protect national security.<br>11. Basic issues of protecting national security and ensuring social order and safety<br>Module II: National defense and security work<br>1. Preventing and combating the strategy of "peaceful evolution", riots and overthrow by forces hostile to the Vietnamese revolution.<br>2. Some basic contents about ethnicity, religion, fighting against hostile forces taking advantage of ethnic and religious issues to sabotage the Vietnamese revolution. |

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| | 3. Preventing and combating of violations of laws on environmental protection.<br>4. Preventing and combating violations of laws on ensuring traffic order and safety.<br>5. Preventing and combating certain types of crimes that harm the honor and dignity of others.<br>6. Information security and prevention and combat of law violations in cyberspace.<br>7. Non-traditional security and non-traditional security threats in Vietnam<br>Module III: General Military<br>1. Living, studying, and working regime during the day and week<br>2. Regular order regimes, internal order arrangements in the barracks<br>3. General understanding of troops and branches in the army.<br>4. Order the team of each person with a gun.<br>5. Unit team command.<br>6. General understanding of military topographic maps.<br>7. Prevent enemy fire attacks with high-tech weapons.<br>8. Three military disciplines coordinate<br>Module IV: Infantry combat techniques and tactics<br>1. AK24 submachine gun shooting techniques.<br>2. Features, structure, and usage of some commonly used grenades. Throw grenades.<br>3. Each person in battle attacks<br>4. Each person in defensive combat<br>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 |

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| | prescribed study period and are not allowed to leave at the end of the day. |
| Reading list | 1. National Defense and Security Education Curriculum (Volume 1)<br>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; Dau Tran Anh Nguyet |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lecture, Discussion |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 30 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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:<br>1. Explain fundamental concepts of inorganic and organic chemistry relevant to materials science, including bonding, acid–base, redox, and major functional groups.<br>2. Describe how these chemical principles determine the structure, properties, and applications of key materials such as oxides, ceramics, glass, alloys, polymers, and nanomaterials. |

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| | 3. Apply knowledge of inorganic and organic compounds to analyze and discuss the role of chemistry in the design and fabrication of advanced materials.<br>4. Perform basic laboratory techniques for synthesizing, purifying, and characterizing representative inorganic and organic compounds.<br>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.<br>- 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 |

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| | 2. Bradley D. Fahlman, *Materials Chemistry,* Springer, 2011<br>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;<br>4. John McMurry, Organic Chemistry, 9th Edition; Belmont, CA, Thomson Brooks/Cole |

## 37. Fundamental of Solid-State Science

| **Module designation** | **Fundamental of Solid-State Science** , MSC10004 |
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| 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:<br>Lecture: 45 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 4.5 ECTS |
| Required and recommended prerequisites for joining the module | Modern Physics, General Materials Science, General Chemistry 1 |
| Module objectives/intended learning outcomes | This course provides fundamental knowledge of the relationship between the structure of solids – including the ordered arrangement of ions/atoms and the electronic energy states – and the thermal, electrical, and optical properties of materials, both in the bulk and at the surface. Building on this foundation, students will be able to interpret the properties of solids through an understanding of their atomic–electronic structures and their interactions with external perturbations under both equilibrium and nonequilibrium conditions.<br>After completing this course the students should be able to: |

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| | 1. Establish an understanding of various types of bonding, relaxtion, and reconstruction in solids, both in the bulk and at surfaces with different structures and symmetries.<br>2. Establish an understanding of the impact of lattice vibrational modes on the heat capacity and heat transport of crystalline solids.<br>3. Understand the fundamentals for analyzing the atomic and electronic structures in the bulk and at the surfaces of solids using diffraction and spectroscopic techniques, including X-ray diffraction, low-energy electron diffraction, secondary electron spectroscopy, Auger electron spectroscopy, and photoelectron spectroscopy.<br>4. Understand band theory in periodic potentials for both bulk and surface systems, and apply it to explain the behavior of electrons and holes in metals, semiconductors, insulators, as well as at their surfaces and interfaces.<br>5. Understand the interaction mechanisms of optical radiation with semiconductors and dielectrics, and their optical properties |
| Content | 1. Crystal structures in the bulk and at solid surfaces (6 hours)<br>2. Lattice vibrations – phonons and thermal properties of solids (6 hours)<br>3. Experimental methods for analyzing atomic and electronic structures in the bulk and at solid surfaces (9 hours)<br>4. Band structure in bulk and at solid surfaces – types of surface states (9 hours)<br>5. Equilibrium and non-equilibrium phenomena in bulk semiconductors and at heterojunction interfaces (9 hours).<br>6. Optical properties in the bulk and at the surfaces of solids (6 hours) |
| Examination forms | Assessment, Discussion, Write exam |

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| Study and examination requirements | 50 % |
| Reading list | 1. Nguyễn Thế Khôi, Giáo trình vật lý chất rắn, NXB ĐH Sư Phạm, 2024<br>2. Lê Khắc Bình, Nguyễn Nhật Khanh, Vật lý chất rắn, NXB ĐHQG Tp.HCM, 2002<br>3. C. Kittel, Introduction to Solid State Physics, J. Wiley and Sons, 8th Edition<br>4. H Ibach and Hans Lüth, Solid-State Physics: An Introduction to Principles of Materials Science, Springer, 2009<br>5. Simon M. Sze and Kwok K. Ng, Physics of Semiconductor Devices, Wiley-Interscience, 2006<br>6. K. Oura, V.G. Lifshits, A.A. Saranin, A.V. Zotov, and M. Katayama, Surface Science – An Introduction, Springer, 2003<br>7. John C. Vickerman and Ian S. Gilmore, Surface Analysis – The Principal Techniques, 2nd Edition, John Wiley & Sons, 2009 |

## 38. Materials Characterization Practice

| **Module designation** | **Materials Characterization Practice, MSC10018** |
|---|---|
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Tạ Thị Kiều Hạnh, Huỳnh Nguyễn Thanh Luận, Tống Hoàng Tuấn, Lê Khắc Tốp, Đặng Vinh Quang, Mai Ngọc Xuân Đạt |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Listenning, practising and discussing |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Laboratory: 60 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 4 |
| Required and recommended prerequisites for joining the module | Materials Characterization Methods, Materials Synthesis Laboratory |
| Module objectives/intended learning outcomes | This course provides students with knowledge and skills in the analysis of nanostructured materials in the form of nanoparticles, nanotubes, nanorods. This course will help students to have the knowledge and skills needed to conduct graduation thesis/seminar as well as in the working process in the future. |
| Content | 1. Practice the FT-IR analysis method<br>2. Practice the Hall analysis method<br>3. Practice the XRD analysis method<br>4. Practice the UV-Vis analysis method |

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| | 5. Practice the Raman analysis method<br>6. Practice the element analysis method |
| Examination forms | Lab work : 50%<br>Final Exam: 50% |
| Study and examination requirements | • Strictly follow the rules and regulations of the Faculty and the School.<br>• Strict compliance with laboratory safety regulations.<br>• Attend 100% of lab sessions.<br>• Attending school on time as scheduled, students who are late for > 10 minutes may not enter the laboratory and are considered absent from the class that day.<br>• Write a full test report and submit it on time. |
| Reading list | Practice text in Materials Characterization Laboratory (Faculty of Materials Science and Technology) |

## 39. Introduction to Biomaterials

| **Module designation** | Introduction to Biomaterials |
|---|---|
| Semester(s) in which the module is taught | 4th semester |
| Person responsible for the module | Ha Van Linh, Msc |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lecture, Discussion |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 will be able to explain the fundamental biological processes of metabolism, homeostasis, reproduction, development, and genetics.<br>Students will be able to demonstrate an understanding of the basic principles of bacteriology, virology, immunology, and provide an overview of the nature of pathogenic microorganisms.<br>Students will be able to analyze the pathogenic mechanisms of certain diseases related to these microorganisms. |
| Content | Chapter 1: Knowledge of Cellular Biology |

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| | Lesson 1.1: Biological Macromolecules (2 hours)<br>Lesson 1.2: Vitamins, Enzymes, and Hormones (3 hours)<br>Lesson 1.3: Chromosomes and Cell Division (2 hours)<br>Lesson 1.4: Structure and Function of Membranes, Metabolic Exchange through Membranes (3 hours)<br>Chapter 2: Knowledge of Medical Biochemistry<br>Lesson 2.1: Overview of Substance Metabolism<br>Overview of Energy Metabolism – Respiration and Photosynthesis<br>Lesson 2.2: Glucids and Glucid Metabolism (2 hours)<br>Lesson 2.3: Lipids and Lipid Metabolism (2 hours)<br>Lesson 2.4: Nucleotides, Nucleic Acids, and Nucleic Acid Metabolism (2 hours)<br>Lesson 2.5: Proteins, Protein Biosynthesis, and Protein Metabolism (2 hours)<br>Chapter 3: Knowledge of Medical Microbiology (10 hours)<br>Lesson 3.1: Overview of Medical Microbiology (1 hour)<br>Lesson 3.2: Morphology, Structure, and Physiology of Bacteria, Gram-Positive and Gram-Negative Bacteria, Antigen-Antibody Reactions (3 hours)<br>Lesson 3.3: Resident Microbial Flora, Bacterial Metabolism, and Growth (3 hours)<br>Lesson 3.4: Infections and Antibiotics (2 hours)<br>Lesson 3.5: Overview of Viruses<br>Chapter 4: Knowledge of Hematology - Immunology (10 hours)<br>Lesson 4.1: Physiology and Biochemistry of Blood, Blood Group Systems (2 hours)<br>Iron, Hemoglobin, Erythrocyte Antigens-Antibodies<br>Mechanisms and Inhibitors of Blood Coagulation (3 hours)<br>Lesson 4.2: Antigens-Antibodies, Complement System, Antigen-Antibody Reactions Leukocyte-Platelet Antigen Systems (2 hours) |

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| | Lesson 4.3: Immune Response & Non-Specific Immunity Vaccines and Immune Sera (2 hours)<br>Lesson 4.4: Certain Immunological and Metabolic Disorders, Imbalances, and Dysfunctional Organs (1 hour)<br>Review |
| Examination forms | Midterm Exam: 10%<br>Regular Assessment: 10%<br>Discussion: 10%<br>Group Presentation: 20%<br>Final exam: 50% |
| Study and examination requirements | Minimum class attendance: 70% of class sessions |
| Reading list | 1. Đỗ Đình Hồ (2003). Hóa sinh y học. Nhà xuất bản Y học.<br>2. Nguyễn Thanh Bảo (2002). Vi khuẩn học. Nhà xuất bản Y học.<br>3. Văn Đình Hoa (2011). Sinh lý bệnh và Miễn dịch. Nhà xuất bản Y học.<br>4. Trịnh Văn Bảo (2011). Sinh học. Nhà xuất bản Giáo dục Việt Na |

## 40. Thermodynamics of Materials

| **Module designation** | **Thermodynamic Materials,** MSC10002 |
|---|---|
| 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:<br>Lecture: 30 hour(s)<br>Private study including examination preparation, specified in hours[1]: 60 |
| Credit points | 3 ETCS |
| 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<br>Skills: cognitive and practical abilities for which knowledge is used<br>Competences: integration of knowledge, skills and social and methodological capacities in working or learning situations |
| Content | Chapter 1: Principles of thermodynamics<br>Chapter 2: Phase diagram<br>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.

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

## 41. Material Fabrication Methods 1

| **Module designation** | **Material Fabrication Methods 1** , MSC10010 |
|---|---|
| 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:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 3 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 |

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| 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).<br>2. Handbook of ring-opening polymerization, Dubois Philippe, Coulembier Olivier, Raquez Jean-Marie, Wiley-VCH Verlag GmbH & Co (2009). |

## 42. Material Fabrication Methods 2

| **Module designation** | **Material Fabrication Methods 2** , MSC10011 |
|---|---|
| Semester(s) in which the module is taught | 5th semester |
| Person responsible for the module | Phạm Kim Ngọc, Tạ Thị Kiều Hạnh, Trần Thị Như Hoa |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | lecture, lesson |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 | + Provide students with basic knowledge of the theoretical foundations of inorganic material synthesis methods<br>+ Have the skills to search, exploit, process and apply information about knowledge related to the subject<br>+ 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). |

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| | Students will apply the above theoretical foundations to the experimental course of material synthesis. |
| Examination forms | Regular Test Scores<br>End of Semester Exams |
| Study and examination requirements | • Minimum attendance for theory classes: 70%<br>• Minimum attendance for practical classes: 90%<br>• Minimum attendance for exercises: 50%<br>• 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<br>2. Vật liệu Kỹ thuật, Nguyễn Khắc Xương (2016). NXB Bách Khoa Hà Nội<br>3. Giáo trình vật liệu nano, Nguyễn Đại Hải |

## 43. Material Characterization Methods 1

| **Module designation** | **Material Characterization Methods 1** , MSC10015 |
|---|---|
| Semester(s) in which the module is taught | 5th semester |
| Person responsible for the module | Do Thi Vi Vi |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lecture |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 15 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 | Students will be able to understand and distinguish the properties of materials.<br>Students will be able to recognize the critical role of advanced materials in fostering sustainable development for the future.<br>Students will be able to comprehend the structure and operating principles of material analysis equipment.<br>Students will be able to understand the purpose and significance of various material analysis methods. |

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| | Students will be able to apply appropriate analysis methods based on the properties and type of material being studied.<br>Students will be able to interpret and analyze measurement results related to the morphology and structure of materials.<br>Students will be able to synthesize and compare results obtained from different analysis methods.<br>Students will be able to actively engage in lessons, effectively absorb new knowledge, and provide constructive feedback. |
| Content | Chapter 1: Introduction to Material Properties<br>Crystal Structure<br>Lesson 1.1: General introduction to crystal structures and crystallographic characteristics of materials<br>Lesson 1.2: Crystal structures of various materials<br>Chapter 2: Structural Analysis by X-Ray Diffraction<br>Lesson 2.1: Diffractometers and principles of operation<br>Lesson 2.2: Methods for determining structure, lattice constants, and indices of crystal planes<br>Chapter 3: Microscopy Analysis Techniques<br>Lesson 3.1: Optical Microscopy<br>Lesson 3.2: Transmission Electron Microscopy (TEM)<br>Lesson 3.3: Scanning Electron Microscopy (SEM) and Energy-Dispersive X-ray Spectroscopy (EDS)<br>Lesson 3.4: Atomic Force Microscopy (AFM)<br>Lesson 3.5: Kelvin Probe Microscopy – Charge transport analysis<br>Chapter 4: Recent Advanced Analysis Methods<br>Lesson 4.1: Scanning Transmission Electron Microscopy (STEM)<br>Lesson 4.2: High-Resolution Transmission Electron Microscopy (HRTEM) combined with Selected Area Electron Diffraction (SAED)<br>Lesson 4.3: X-ray Photoelectron Spectroscopy (XPS) |

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| | Chapter 5: Seminar 1: Comparison of Methods for Morphological and Structural Analysis of Materials<br>Lesson 5.1: Differences between analysis methods<br>Lesson 5.2: Selection of suitable methods for specific experimental sample conditions<br>Chapter 6: Seminar 2: Introduction to Data Processing Software<br>Practical instructions and classroom exercises<br>Final Review |
| Examination forms | Essay |
| Study and examination requirements | Attendance at least 80% |
| Reading list | 1. Yang Leng (2008). Materials Characterization: Introduction to Microscopic and Spectroscopic Methods. John Wiley & Sons (Asia) Pte Ltd.<br>2. Peter E. J. Flewitt, Robert K. Wild (2017). Physical Methods for Materials Characterisation (3rd Edition). CRC Pre |

## 44. Material Characterization Methods 2

| **Module designation** | **Material Characterization Methods 2** , MSC10016 |
|---|---|
| Semester(s) in which the module is taught | 5th semester |
| Person responsible for the module | Tu Thi Tram Anh |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 22.5 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 will be able to understand methods for analyzing the biocompatibility of materials.<br>Students will be able to comprehend the structure and operating principles of material analysis equipment, as well as the purpose and significance of each analysis method.<br>Students will be able to identify the properties of various materials.<br>Students will be able to apply appropriate analysis methods based on the properties to be analyzed and the type of material. |

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| | Students will be able to interpret and analyze the results of material analysis effectively.<br>Students will be able to synthesize and compare results from different analysis methods.<br>Students will demonstrate an understanding of professional roles, responsibilities, and ethics when working in research and development, quality control, and material property analysis fields. |
| Content | Chapter 1: Methods for Analyzing the Biocompatibility of Materials<br>Lesson 1.1: Methods for analyzing the biocompatibility of materials<br>Lesson 1.2: Methods for testing the cytotoxicity of materials<br>Lesson 1.3: Methods for testing allergic or hypersensitivity reactions of materials<br>Chapter 2: Introduction to Material Properties<br>Lesson 2.1: Crystal structures and physical states of materials<br>Lesson 2.2: Discussion of specific applications associated with characteristic material properties<br>Chapter 3: Structural Analysis by X-ray Diffraction<br>Lesson 3.1: Diffractometers and principles of operation<br>Lesson 3.2: Methods for determining structures, lattice constants, and indices of crystal planes<br>Chapter 4: Microscopy Analysis Techniques<br>Lesson 4.1: Optical microscopy<br>Lesson 4.2: Transmission electron microscopy (TEM)<br>Lesson 4.3: Scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDS)<br>Lesson 4.4: Atomic force microscopy (AFM)<br>Chapter 5: Data Processing Software and Experimental Application<br>Lesson 5.1: Introduction to data processing software, usage guidance, and classroom practice |

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| | Lesson 5.2: Applying theoretical knowledge to interpret and evaluate experimental results<br>Chapter 6: Introduction to Mechanical Properties and Testing Methods for Materials<br>Lesson 6.1: Stress-strain properties and tensile strength of materials<br>Lesson 6.2: Stress-strain properties and impact, bending, and friction resistance of materials<br>Lesson 6.3: Practical exercises using equipment to evaluate tensile, bending, and impact properties of materials |
| Examination forms | Progressing tests: 40%<br>Final exam: 60% |
| Study and examination requirements | Attendance at least 80% |
| Reading list | 1. Yang Leng. (2008). Materials Characterization: Introduction to Microscopic and Spectroscopic Methods. John Wiley & Sons (Asia) Pte Ltd.<br>2. Lê Vũ Tuấn Hùng. (2013). Kỹ thuật phân tích vật liệu [Material Analysis Techniques]. NXB ĐHQG Tp.HCM. |

## 45. Polymer and Composite Materials

| **Module designation** | **Polymer and Composite Materials** , MSC10008 |
|---|---|
| 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:<br>Lecture: 22.5 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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<br>• Participate in group discussion on specific subjects |

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| | • Analyze and prepare reports on specific assigned topics individually or in group collaboration<br>• Use body language and tone of voice to enhance their presentations<br>• Use slides and visual aids effectively<br>• Deliver an enthusiastic and well-practised presentation!<br>Identify/explain the principles of chemical safety in polymer/polymer composite materials<br>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.<br>□ 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.<br>2. Emo Chiellini, Helena Gil, Gerhart Braunegg, Johanna Buchert, Paul Gatenholm, and Maarten van der Zee, |

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| | Biorelated polymers, Kluwer Academic / Plenum Publishers, 2001. |

## 46. Material Fabrication Methods Practice

| **Module designation** | **Material Fabrication Methods Practice**, MSC10017 |
|---|---|
| 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:<br>Lecture: 0 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 60 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 4 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.<br>Apply knowledge of material analysis techniques proficiently.<br>Demonstrate proficiency in operating material fabrication equipment and material analysis instruments.<br>Utilize data processing tools and software effectively.<br>Work independently and contribute to teamwork efficiently.<br>Exhibit responsibility in adhering to laboratory safety regulations and protocols. |

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| Content | Lesson 1: Fabrication of Bulk $SiO_2$ Materials<br>Lesson 2: Fabrication of ZnO Thin Films Using the Sol-Gel Method<br>Lesson 3: Investigation of Curing Agent Content in Thermosetting Epoxy Resins and Mechanical Properties of Natural Fiber-Reinforced Composites<br>Lesson 4: Synthesis of Magnetic $Fe_3O_4$ Nanoparticles<br>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.<br>2. Wang Xuanze. 2020. Preparation, Synthesis, and Application of Sol-Gel Method. |

## 47. Ceramics, Metals and Semiconductors Materials

| **Module designation** | **Ceramics, Metals, and Semiconductors Materials**, MSC10005 |
|---|---|
| Semester(s) in which the module is taught | 5th semester |
| Person responsible for the module | Pham Kim Ngoc, Dang Vinh Quang |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lecture, Homework |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 37.5 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: 0 hour(s)<br>Private study, including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 4.75 ECTS |
| Required and recommended prerequisites for joining the module | • General Materials Science<br>• Fundamentals of Solid Matter Science |
| Module objectives/intended learning outcomes | Knowledge: Classify and determine the characteristics, properties, and applications of ceramic, metal and semiconductor materials. Apply to calculate the current in semiconductors: diffusion current, drift current, carrier concentration… Explain the characteristics of metal-semiconductor, semiconductor-semiconductor contact. Explain the operation principles of diodes, transistor devices (BJT, FET...) |

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| | Skill: Be able to find documents, read comprehension, and statistical related data, and do exercises related to semiconductors.<br>Attitude: Have responsibility in study and work. |
| Content | Chapter 1: Introduction of ceramic, metal and semiconductor (Characteristics, Kinds, Properties, Applications).<br>Chapter 2: Ceramic and Metal Materials (Structure, Fabrication Process, Property Evaluation).<br>Chapter 3: Semiconductor (Energy band structure, Carriers, Mobility, Drift current, Diffusion current).<br>Chapter 4: Metal- Semiconductor contact, p-n contact characteristics.<br>Chapter 5: Principles and Characteristics of Semiconductor devices (BJT, FET...) |
| Examination forms | Mid exam, Final exam, Homework |
| Study and examination requirements | Final score: >= 5 |
| Reading list | Đỗ Quang Minh, Kỹ thuật sản xuất vật liệu gốm sứ, NXB ĐHQG HCM (2012).<br>Nguyễn Đức Thắng, Giáo trình công nghệ kim loại, NXB Giáo dục VN (2013).<br>Phùng Hồ, Vật lý bán dẫn, NXB KHKT (2021)<br>Lê Khắc Bình, Cơ sở vật lý chất rắn, NXB ĐHQG HCM (2006) |

## 48. Materials simulation & modelling (new course)

| Module designation | Materials simulation & modelling |
|---|---|
| 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:<br>Lecture: 15 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 30 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 |

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| | Lesson 1.1: Materials Science, Statistical Physics, and Molecular Dynamics Simulations<br>Lesson 1.2: Molecular dynamics simulation methods: Algorithms<br>Lesson 1.3: Molecular dynamics simulation methods: Force Fields and Software Packages<br>Lesson 1.4: Molecular dynamics simulation techniques: setup for material systems<br>Chapter 2: Simulations of Biomolecular Systems<br>Lesson 2.1: Using Gromacs software<br>Lesson 2.2: Practical Molecular Simulations of Biomolecular Systems using Gromacs software<br>Chapter 3: Simulations of Thin Film Material Systems<br>Lesson 3.1: Using LAMMPS software<br>Lesson 3.2: Practical Simulations of Material Systems using LAMMPS software<br>Chapter 4: Project Presentation and Final review<br>Guidelines for Course Project<br>Project Presentation<br>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.<br>2. Molecular Modeling and Simulation_ An Interdisciplinary Guide, Tamar Schlick, Springer, Second Edition, 2010. |

## 49. Technology of Synthesis and Recycle of Polymers

| **Module designation** | **Technology of Synthesis and Recycle of Polymers**, MSC10203 |
|---|---|
| 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 Polymer and Composite Materials Specialization |
| Teaching methods | Active teaching/ Listening, Taking notes |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 22.5 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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;<br>Materials Characterization Techniques 1;<br>Materials Characterization Techniques 2. |
| Module objectives/intended learning outcomes | Understand the continuous or batch processes, the polymerization in a continuous stirred tank or in pipe;<br>Evaluate various methods of polymer synthesis;<br>Understand and evaluate various methods of polymer recycle;<br>Compare and evaluate the polymerization systems, mainly in bulk, with solvent, emulsion, suspension; |

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| | Compare the polymerization of various polymers, namely polyolefins, polycondensation polymers;<br>Select recycling method for polymers;<br>Compare and evaluate hierarchy of polymer recycling;<br>Analyze the relationship between polymer recycling methods. |
| Content | Chapter 1. Technology of Synthesis Polymer (15 hours)<br>Chapter 2. Technology of Recycle Polymer (15 hours) |
| Examination forms | Discussion (20%);<br>Presentation (40%);<br>Final examination (40%). |
| Study and examination requirements | Students are not allowed to be absent for 3/10 weeks |
| Reading list | 1. R.A. Ilyas, S.M. Sapuan, and Emin Bayraktar, Recycling of Plastics, Metals, and Their Composites, CRC Press, 2022.<br>2. Hoàng Ngọc Cường, Công nghệ Tổng hợp và tái chế Polymer, Publisher Vietnam National University - Ho Chi Minh city, 2010. |

## 50. Rubber: Chemistry and Technology

| **Module designation** | **Rubber: Chemistry and Technology** , MSC10209 |
|---|---|
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Nguyen Tuong Vy, Msc |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lecture, seminar, group discussion |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 3 ECTS |
| Required and recommended prerequisites for joining the module | Polymer and Composite materials |
| Module objectives/intended learning outcomes | Knowledge:<br>- Grasp and present the concept of polymer blends and methods of preparing polymer blends<br>- Demonstrate understanding of the structure-property-synthesis relationships of materials<br>Skills:<br>- Analyze experimental data, use tools and software to interpret results and draw meaningful conclusions about material properties.<br>Attitude: |

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| | - 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: Overview of natural rubber (6 hours)<br>Chapter 2: Composition, properties and vulcanization of natural rubber (3 hours)<br>Chapter 3: Vulcanization and Aging of Rubber (6 hours)<br>Chapter 4: Some Types of Technical Rubber (3 hours)<br>Chapter 5: Simple Rubber Product Manufacturing Technology (6 hours)<br>Chapter 6: Sustainable rubber production (3 hours) |
| Examination forms | Mid-term test, Final test and seminar |
| Study and examination requirements | - Students may not miss more than 30% of total classes.<br>- Students must complete all process score columns before being allowed to take the final exam. |
| Reading list | Khoa Học Kĩ Thuật Công Nghệ Cao Su Thiên Nhiên; Cao Su Tính Chất và Ứng Dụng; Epoxy resins- Handbook of occupation dermatology |

## 51. **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:<br>Lecture: 22.5 hours<br>Laboratory/Practical: 15 hours<br>Tutorial/Project Guidance: 5 hours<br>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. |

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| | 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.<br><br>Upon successful completion of this module, students will be able to:<br><br>1. (Understand) Describe the relationship between polymer structure (molecular weight, crystallinity, Tg) and their mechanical properties.<br><br>2. (Apply) Apply standard testing methods (tensile, bending, impact, hardness, abrasion...) to characterize the mechanical behavior of polymer samples.<br><br>3. (Analyze) Analyze experimental data from mechanical tests to determine key parameters (Young's modulus, yield strength, toughness).<br><br>4. (Evaluate) Evaluate and select appropriate polymers for specific applications based on their mechanical property requirements and cost-effectiveness.<br><br>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:<br><br>1. Structure-Property Relationships in Polymers.<br><br>2. Mechanical Behavior: Elastic, Plastic, and Viscoelastic Deformation.<br><br>3. Standard Test Methods: Tensile, Compression, Impact, Hardness, Creep, and Fatigue. |

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| | 4. Analysis of Stress-Strain Curves and Failure Mechanisms.<br>5. Polymer Selection for Engineering Applications and Sustainability.<br>6. Introduction to Advanced Characterization (e.g., DMA). |
| Examination forms | 1. Midterm Examination (30%): Written test covering fundamental principles.<br>2. Laboratory Reports (30%): Reports for lab session<br>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.<br>· Complete and submit all laboratory reports and the final project.<br>· 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:*<br>*Ward, I. M., & Sweeney, J. Mechanical Properties of Solid Polymers. 3rd ed., Wiley, 2012.*<br>*Callister, W. D., & Rethwisch, D. G. Materials Science and Engineering: An Introduction. 10th ed., Wiley, 2018.*<br>*2. Reference Books:*<br>*Shah, V. Handbook of Plastics Testing and Failure Analysis. 3rd ed., Wiley, 2007.*<br>*3. Additional Resources:*<br>*Relevant standards (ASTM, ISO) for polymer testing.*<br>*Recent scientific articles on polymer mechanics from journals like Polymer, Journal of Applied Polymer Science.* |

## 52. 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<br>Lecture: 22.5 hours<br>Laboratory/Practical: 15 hours<br>Tutorial/Project Guidance: 5 hours<br>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. |

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| | 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.<br><br>Upon successful completion of this module, students will be able to:<br><br>1. (**Understand**) **Describe** the principles, advantages, limitations, and typical applications of major polymer processing methods (extrusion, injection molding, blow molding, etc.).<br><br>2. (**Apply**) **Select** appropriate processing parameters (temperature, pressure, screw speed) for a given polymer and product design.<br><br>3. (**Analyze**) **Analyze** the relationship between polymer structure, rheological properties, and its processability by different methods.<br><br>4. (**Evaluate**) **Identify** common defects in polymer products and **propose** corrective actions based on processing conditions.<br><br>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:<br><br>1. Introduction to Polymer Processing: Rheology of polymer melts, thermal properties. |

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| | 2. Extrusion Processes: Single-screw extrusion, profile extrusion, blown film extrusion.<br>3. Molding Processes: Injection molding, blow molding, compression molding, thermoforming.<br>4. Mixing and Compounding: Principles and equipment.<br>5. Process-Property Relationships: How processing affects final product properties (crystallinity, orientation).<br>6. Quality Control and Defect Analysis in processing.<br>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.<br>2. Laboratory Reports (30%): Reports on practical sessions (e.g., setting up extrusion parameters, identifying defects).<br>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.<br>· Complete and submit all laboratory reports and the case study project.<br>· 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:<br>Osswald, T. A., & Hernández-Ortiz, J. P. *Polymer Processing: Modeling and Simulation*. Hanser Publishers, 2006.<br>Strong, A. B. *Plastics: Materials and Processing*. 3rd ed., Pearson Prentice Hall, 2006. |

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

## 53. Polymer Testing and Characterization Methods

| **Module designation** | **Polymer Testing and Characterization Methods** , MSC10204 |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Hoàng Thị Đông Quỳ |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | Listening, Taking Notes, Solve assignments |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 37.5 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 4.75 ECTS |
| Required and recommended prerequisites for joining the module | Polymer and composite materials; Material Characterization Technique 1; Material Characterization Technique 1. |
| Module objectives/intended learning outcomes | Distinguish each analysis method;<br>Evaluate advantages and disadvantages of each analysis method;<br>Select analysis methods and how to prepare sample;<br>Describe the process to prepare sample;<br>Interpret of structures, contents of some common polymers from analysis data;<br>Interpret of thermal properties of some common polymers from analysis data. |

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| Content | Chapter 1. Introduction of polymer analysis methods (3 hours);<br>Chapter 2. Characterization of polymers by FTIR method (8.5 hours);<br>Chapter 3. Characterization of polymers by Raman spectroscopy method (7 hours);<br>Chapter 4. Characterization of polymers by NMR spectroscopy method (3 hours);<br>Chapter 5. Characterization of polymers by DSC method (8 hours);<br>Chapter 6. Characterization of polymers by TGA method (8 hours) |
| Examination forms | Exercise in class (20%);<br>Midterm examination (30%);<br>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;<br>Students should take a ruler, a pocket calculator to solve assignments;<br>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;<br>2. Hoàng Ngọc Cường, Phân tích polyme bằng các phương pháp phổ FTIR, Raman và NMR, Publisher Vietnam national |

## 54. Composite and Nanocomposite Materials

| **Module designation** | **Composite and Nanocomposite Materials** , MSC10211 |
|---|---|
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Nguyen Thai Ngoc Uyen, Vu Nang An |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | Lecture, seminar |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 45 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 4.5 ECTS |
| Required and recommended prerequisites for joining the module | Introduction in Materials Science; Polymer and Composites Materials |
| Module objectives/intended learning outcomes | Knowledge: Students are able to describe the composition, chemical structures of materials and relate to properties of composites or nanocomposites. In addition, students are abl to select the manufacturing process based on individual components<br>Skills: Students are able to read scientific reports, summary and oral present their findings |
| Content | Introduction (1 hours)<br>Chapter 1: The composition of composite including matrix and reinforced materials (9 hours) |

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| | Chapter 2: Properties of composites (2 hours)<br>Chapter 3: Manufaction of composites by open and closed-molding technique (4 hours)<br>Chapter 4. Nanomaterials as reinfoced for composites (5 hours)<br>Chapter 5: Fabrication of nanocomposite including in-situ polymerization, melt-blending method and solution methods (5 hours)<br>Chapter 6: The applications of nanocomposites (5 hours) |
| Examination forms | Presentation (15%)<br>Mid-term exam (Multiple choices) 25%<br>Assigment (Multiple choices): (20%)<br>Final exam (essay): 40% |
| Study and examination requirements | Minimum attendance of lectures is about 70%<br>Attend all reporting sessions, actively discuss and submit all assignments |
| Reading list | 1. William D. Callister, 2009, Materials science and engineering. An introduction, 8th edition. John Wiley & sons<br>2. T.G. Gutowski, 1997, Advanced composites manufacturing 1, John Wiley & sons |

## 55. Modification of Polymers

| **Module designation** | **Modification of Polymers** , MSC10217 |
|---|---|
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Do Thi Vi Vi, PhD |
| Language | Vietnamese |
| Relation to curriculum | Elective, Polymer and Composite Materials Specialization |
| Teaching methods | Lecture |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 |
| Module objectives/intended learning outcomes | Mục tiêu của môn học này cung cấp kiến thức về các phương pháp biến tính polymer. |
| Content | Môn học này trang bị cho sinh viên các kiến thức về phương pháp tạo ra polymer mới, thay đổi cấu trúc polymer hoặc thay đổi một số tính chất của polymer, nhằm mở rộng lĩnh vực ứng dụng của polymer. |
| Examination forms | Essay |
| Study and examination requirements | Attendance at least 80% |

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| Reading list | 1. Polymer synthesis, Kowsari E., Nomura Kotohiro , Baca Svetlana G., Ward Michael D, Nova Science (2012);<br>2. Hóa học các hợp chất cao phân tử, Ngô Duy Cường, Đại học Quốc gia (2004). |

## 56. Polymer Blends

| **Module designation** | **Polymer Blends** , MSC10206 |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Nguyen Tuong Vi, Msc |
| Language | Vietnamese |
| Relation to curriculum | Elective, Polymer and Composite Materials Specialization |
| Teaching methods | |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 3 ECTS |
| Required and recommended prerequisites for joining the module | • Thermodynamics of materials<br>• Polymer and Composite Materials |
| Module objectives/intended learning outcomes | Knowledge:<br>- Grasp and present the concept of polymer blends and methods of preparing polymer blends.<br>- Describe and explain the structure and properties of polymer blends<br>- Explain the relationship between structural formula, composition, structure - morphology, physical states and mechanical properties of polymer mixtures.<br>Skills: |

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| | - Design a simple polymer mixture system that meets some initial requirements<br>- Ability to read and understand specialized documents in Vietnamese and English |
| Content | Chapter I: Introduction to polymer blends (3 hours)<br>Chapter 2: Thermodynamics of polymer blends (6 hours)<br>Chapter 3: Compatibility and Compatibility Determination Techniques (6 hours)<br>Chapter 4: Polymer blend preparation techniques (3 hours)<br>Chapter 5: Mechanical properties of polymer blends (6 hours)<br>Chapter 6: Applications of polymer mixtures and physical and chemical properties of polymer blends (3 hours) |
| Examination forms | Oral presentation (30%)<br>Exercises (20%)<br>Final test (50%) |
| Study and examination requirements | Students may not miss more than 30% of total classes.<br>Students must complete all process score columns before being allowed to take the final exam. |
| Reading list | Lecture notes<br>Polymer blends Handbook |

## 57. Polymer Additives

| **Module designation** | **Polymer Additives** , MSC10205 |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | HOANG Thi Dong Quy |
| Language | Vietnamese |
| Relation to curriculum | Elective, Polymer and Composite Materials Specialization |
| Teaching methods | KWL (Know, Want to know, Learn), Group discussion, Lectures, Seminar |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 22.5 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 | 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 |

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| | 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: Group seminar/Workshop |
| Examination forms | Home work; Final theoretical exam; Presentation |
| Study and examination requirements | • Strictly follow the rules and regulations of Department as well as University.<br>• Must not be absence more than 3 sessions of lectures.<br>• For any cheating in the process of doing an assignment or an exam, students will be subjected to any disciplinary ac |
| Reading list | 1. J. Stepek · H. Daoust. Additives for Plastics. Springer Science+ Business Media, LLC, 1983.<br>2. Jiri E. Kresta. Polymer Additives. Plenum Press, New York and London, 1984<br>3. Johan Bieleman. Additives for Coatings. Wiley-VCH, New York, 2000. |

## 58. 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:<br>Lecture: 0 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 60 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 4 ECTS |
| Required and recommended prerequisites for joining the module | - Polymer mechanical properties<br>- Polymer and Composite Materials<br>- Processing methods of polymer materials |
| Module objectives/intended learning outcomes | Provide knowledge and skills for students about plastic processing machines, such as: Internal mixer, rolling-mill, press, extruder, testing machines… commonly used in industry. From there students will contacted and practiced directly on these machines to prepare some simple plastic products and test properties of them. Students will have a real view about the job which they are be able to do in future. |
| Content | 1st Week: Vulcanization of Natural Rubber, The internal mixer and mixing technology for making composite |

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| | materials based on PP resin, Composite materials from glass fiber and thermosetting polymer (16 hours)<br>2nd Week: The practice of measuring polymer mechanics, analyze and reports (36 hours)<br>3rd Week: Review knowledge and final examination (8 hours) |
| Examination forms | Report + Regular check points (60%), Final examination (40%) |
| 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.<br>2. Nguyen Huu Tri, Natural Rubber Technology, Youth Publishing, 2004.<br>3. Andrew Ciesielski, An Introduction to rubber technology, Rapra technology LTD, 1999. |

## 59. 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:<br>Lecture: 0 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 60 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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<br>• Polymer material processing techniques<br>• Material manufacturing methods<br>• Rubber chemistry and technology. |
| Module objectives/intended learning outcomes | Knowledge:<br>Demonstrate understanding of the structure-property-synthesis relationships of materials.<br>Skills:<br>Analyze experimental data, use tools and software to interpret results and draw meaningful conclusions about material properties.<br>Attitude: |

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| | 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)<br>Chapter 2: Determination of viscosity average molecular weight of polyvinylancol (10 hours)<br>Chapter 3: Synthesis of poly Phenol ureformandehide (10 hours)<br>Chapter 4: Degradation of Natural Rubber Latex by H2O2 and Heat System (10 hours)<br>Chapter 5: Synthesis of Polyvinyl Alcohol (10 hours)<br>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.<br>. Students must complete 100% of the internship sessions to be eligible to take the final exam. |
| Reading list | Principles of polymer engineering, Engineering polymers |

## 60. Industrial internship

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| Module designation | Industrial Internship |
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Trần Thị Thanh Vân<br>Hà Thúc Chí Nhân<br>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) | (Estimated) Total workload: 112.5 hours<br>Internship at Enterprise: 45 hours (students work at a company for 6 weeks, 15h/week)<br>Guidance & Seminars (at University): 22.5 hours<br>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<br>Mechanical properties of polymers<br>Material processing techniques<br>Internship in material manufacturing methods<br>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.<br><br>Intended learning outcomes:<br>• Apply theoretical knowledge of materials science and technology to analyze and describe real-world industrial processes.<br>• Analyze the relationship between material selection, manufacturing techniques, and the final product's performance and quality. |

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| | • Evaluate the efficiency, challenges, and potential improvements of a specific process or system observed at the enterprise.<br>• Critically reflect on the professional working environment, safety standards, and management practices, comparing them with academic knowledge.<br>• 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:<br><br>I. Overview of the Enterprise:<br><br>• Introduction to the enterprise, its main activities, products, services, and work processes.<br>• Understanding the organization, management structure, and company regulations.<br>• Comparing company regulations with academic regulations.<br><br>II. Material Production and Fabrication Processes:<br><br>• Studying real-world technologies, material manufacturing processes, and product production at the enterprise.<br>• Learning about the equipment and machinery used in the production process.<br>• Participating in specific steps within the production/operational process under the guidance of enterprise staff.<br><br>III. Material/Product Quality Analysis and Control:<br><br>• Understanding methods for analyzing material properties applied at the enterprise.<br>• Studying procedures and methods for product quality inspection and evaluation.<br>• Participating in activities involving raw material inspection, process control, and finished product inspection.<br><br>IV. Management and Operational Aspects: |

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| | • Market analysis related to the enterprise's products.<br>• Learning about product design and project management.<br>• Assessing production capacity and risk management.<br>• Developing work progress schedules and managing time.<br>• Considering the environmental impact of the production process.<br>• Understanding the importance of employee training and intellectual property.<br>• Establishing feedback mechanisms during the work process.<br><br>V. Data handling and Reporting:<br><br>• Collecting data and information related to internship activities.<br>• 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.<br><br>□ 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.<br><br>□ 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.<br>• Complete a minimum of 90 hours of internship at the approved enterprise. \| |

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| | • Obtain a positive evaluation from the enterprise supervisor.<br>• Submit a complete Internship Portfolio and Final Report that meets the quality standards.<br>• Achieve a minimum score of 5.0/10 overall. |
| Reading list | • Faculty's Guide for Internship Report Writing.<br>• Alley, M. The Craft of Scientific Writing. 4th ed., Springer, 2018<br>• ASM Handbook, Volume 20: Materials Selection and Design. |

## 61. Specialized Biology

| **Module designation** | **Specialized Biology** , MSC10302 |
|---|---|
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Ha Van Linh, Msc |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lecture, lesson, Senimar |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 3 ECTS |
| Required and recommended prerequisites for joining the module | Fundamental biology |
| Module objectives/intended learning outcomes | Apply the basic biochemical, molecular and immunological techniques for a variety of laboratory procedures |
| Content | This course provides students with a broad overview of the basic biochemical, molecular and immunological techniques that are commonly used in modern biomedical research. The course consists of three sections: general biochemical methods, analysis and isolation of nucleic acids and recombinant DNA, analysis protein and immunological procedures |

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| | Students anticipating careers involving biological or medical research at any level will benefit from this course |
| Examination forms | Mid-term Examination, Seminar and Final examination |
| Study and examination requirements | Attend class (>50% contact hours). Mid-term examination > 3 points (3/10) and Final examination > 4 points (4/10) |
| Reading list | Vật liệu y sinh 1. Frederick M. Ausubel, Roger Brent, Robert E. Kingston, David D. Moore, J.G. Seidman, John A. Smith, Kevin Struhl (eds.) (2003). Current Protocols in Molecular Biology . John Wiley & Sons Inc. |

## 62. Functional Biomedical Materials

| **Module designation** | **Functional Biomedical Materials** , MSC10304 |
|---|---|
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Từ Thị Trâm Anh |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lecture, lesson, seminar |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 45 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 | Module objectives<br>Knowledge: Distinguish basic concepts of material science and biology and their relevance to biomedical materials. Predict issues related to interactions between materials and living tissues.<br>Skill: Predict appropriate materials for each biomedical application.<br>ATTITUDE: Work in teams to present reports on specialized topics based on Vietnamese and English references.<br>Learning outcomes |

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| | KNOWLEDGE<br>Explain the basic principles of biology and their relevance to biomedical materials.<br>Analyze biological reactions to biomedical materials, including protein chemistry, cell-material interactions, and the impact of biomedical materials on tissue responses.<br>Select surface modification methods and sterilization techniques to ensure the safety and effectiveness of biomedical materials in medical applications.<br>SKILLS<br>Evaluate the properties and applications of various biomedical materials, including metals, polymers, ceramics, and natural biomaterials, as well as their advantages and limitations in different medical applications.<br>Evaluate clinical applications of biomedical materials, including drug delivery systems, tissue engineering, and clinical applications, and their potential impact on healthcare.<br>ATTITUDE<br>Establish, operate, and manage teams.<br>Establish, operate, and manage teams. |
| Content | This course provides knowledge about various types of materials used in the biomedical field such as ceramics, glasses, metals, and biomedical polymers. It explores the characteristics of these materials, interactions between materials and living tissues, and their applications in medicine.<br>Chapter 1 Introduction<br>Lesson 1 Introduction (4 hours)<br>1.1 Definitions<br>1.2 Types of bonds in materials<br>1.3 Types of materials<br>Lession 2 Basic properties of materials (4 hours)<br>Chapter 2 (4 hours)<br>Lesson 1.Disinfection |

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| | Lesson 2 Infections and biofilms<br>Chapter 3 (4 hours)<br>Lesson 1 Interaction between biological materials and living tissue<br>Lesson 2 Some related biological tests<br>Chapter 4 Metal (4 hours)<br>Lesson 1<br>4.1 Titanium and its alloys<br>4.2 Stainless steel<br>4.3 Cobalt–chromium alloys<br>Lesson 2<br>4.4 Nitinol<br>4.5 Tantalum<br>4.6 Magnesium<br>Chapter 5 Polymer<br>Lesson 1 (4 hours)<br>1 Molecular structure of polymers<br>2 Physical states of polymers<br>Lesson 2 (4 hours)<br>1. Common polymeric biomaterials<br>2. Hydrogel<br>3.Nanopolymer<br>Chapter 6 Ceramics (3 hours)<br>1.1 General properties<br>1.2 Classification<br>1.3 Bioceramics<br>1.4 Nanoceramics<br>Chapter 7 Natural biomaterials (3 hours)<br>7.1 Collagen<br>7.2 Elastin<br>7.3 Silk |

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| | 7.4 Chitosan<br>7.5 Cellulose<br>7.6 Alginate<br>7.7 Hyaluronan<br>7.8 Chondroitin sulfate<br>7.9 Coral<br>Chapter 8 Surface treatment of medical implants (3 hours)<br>8.1 Surface modification<br>Chapter 9 Drug delivery systems (4 hours)<br>9.1 Diffusion controlled drug delivery systems<br>9.2 Water penetration controlled drug delivery systems<br>9.3 Chemically controlled drug delivery systems<br>9.4 Responsive drug delivery systems<br>9.5 Particulate systems<br>Chapter 10 Clinical applications (4 hours)<br>10.1 Cardiovascular assist devices<br>10.2 Cardiovascular stents<br>10.3 Dental restoration<br>10.4 Dental implants<br>10.5 Neural prostheses<br>10.6 Opthalmology<br>10.7 Orthopedic implants<br>10.8 Renal<br>10.9 Skin applications |
| Examination forms | Oral presentation, Written |
| Study and examination requirements | - Total score greater than or equal to 5.<br>- Students who do not submit their reports on time are considered as not submitting.<br>- Students who miss more than 20% of the total class hours will be banned from the final exam. |

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| Reading list | C. Mauli Agrawal, Joo L. Ong, Mark R. Appleford, Gopinath Mani, Introduction to Biomaterials: Basic Theory with Engineering Applications, Cambridge University Press, New York, 2014 |

## 63. Molecular Techniques in Diagnostics

| **Module designation** | **Molecular Techniques in Diagnostics** , MSC10305 |
|---|---|
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Hà Vân Linh |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lecture, lesson, Seminar |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 45 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 4.5 ECTS |
| Required and recommended prerequisites for joining the module | SPECIALIZED BIOLOGY |
| Module objectives/intended learning outcomes | Apply the knowledge of basic science and basic medical science to sketch molecular biology related- research in material science<br>Aware of ethical aspects and general ethical guidelines in individual workplaces |
| Content | Molecular techniques in diagnostics is a collection of techniques used to analyze biological markers in the genome and proteome by applying molecular biology to medical testing. |
| Examination forms | Mid-term Examination, Seminar and Final examination |

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| 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. Lela Buckingham, Maribeth Flaws (2007),.Molecular diagnostics: fundamentals, methods, and clinical applications. F.A. Davis Company<br>2. Frederick M. Ausubel, Roger Brent, Robert E. Kingston, David D. Moore, J.G. Seidman, John A. Smith, Kevin Struhl |

## 64. Biomedical Engineering

| **Module designation** | **Biomedical Engineering** , MSC10306 |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Hà Vân Linh |
| Language | Vietnamese |
| Relation to curriculum | Compulsory Biomedical Materials Specialization |
| Teaching methods | Lecture, lesson, Seminar |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 45 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 4.5 ECTS |
| Required and recommended prerequisites for joining the module | SPECIALIZED BIOLOGY |
| Module objectives/intended learning outcomes | Acquire a foundational knowledge of the properties of different biomedical materials and the scientific principles that impact material behavior.<br>Apply knowledge and competences to develop new biomedical materials with desired properties. |
| Content | This course provides knowledge about processing principles and required properties of biological materials for different applications. Interaction between biological materials and living tissue as well as biocompatibility of materials. How materials are designed and manufactured so that they can be |

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| | used in medical treatments. Finally, there are some common applications of biological materials in medicine. |
| 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 | 1. Materials science and engineering: an introduction. Edited by William D. Callister and David G. Rethwisch. John Wiley & Sons Inc, 8th edition, 2010.<br>2. Engineering Materials for Biomedical Applications. Edited by Swee Hin TEOH. World Scientific Publish |

## 65. Surface Modification of Materials

| **Module designation** | **Surface Modification of Materials, MSC10307** |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Assoc. Prof. Dr. Le Viet Hai |
| Language | Vietnamese |
| Relation to curriculum | TC course |
| Teaching methods | Discussion, Practice, Q&A |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 4 ECTS |
| Required and recommended prerequisites for joining the module | General Chemistry, General Biology, Fundamental Biology, Introduction to Materials Science, Materials Fabrication Methods (1, 2), Materials Analysis Methods (1, 2) |
| Module objectives/intended learning outcomes | General objective: This course equips students with basic knowledge about the structure, operating principles, specific parameters, manufacturing processes and applications of biosensors. After studying, students can approach, research and intensive research in the field of biosensors. In addition, in the learning process, students will improve their teamwork skills, writing and presenting thematic reports. In addition, this subject also helps students to be aware of the role and thereby apply biosensors to real life. |

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| | This course equips students with basic knowledge of surface modification techniques and their applications in industrial production, with a particular emphasis on the biomedical field. After studying, students will be able to approach, explore, and conduct in-depth research on surface modification of materials, applying this knowledge to the fabrication of biomaterials and the development of biosensors. In addition, throughout the course, students will enhance their teamwork skills, as well as their abilities in writing and presenting technical reports. The course also raises students' awareness of the importance of surface modification techniques and encourages their application in real-world manufacturing practices. |
| Content | Chapter 1: Overview of Surface Modification of Materials. Chapter 2: Surface Treatment-Based Modification. Chapter 3: Surface Modification via Coatings. Chapter 4: Surface Modification with Thin Layers of Organic Molecules. Chapter 5: Surface Modification of Nanomaterials. Chapter 6: Surface Modification of Biomaterials. Seminar |
| Examination forms | Oral presentation, essay, Team work, In-class Exercises, Homework Assignments, Final Exam |
| Study and examination requirements | Total score greater than or equal to 5. |
| Reading list | Ram Kossowsky and Subhash C. Singhal, Surface Engineering: Surface Modification of Materials (1993);<br>Rachel Williams, Surface modification of biomaterials: Methods, analysis and applications (2011);<br>Trần Đại Lâm, Cảm biến sinh học điện hoá: Nguyên lý, vật liệu và ứng dụng, NXB Khoa học tự nhiên và Công nghệ, Hà Nội, 2014;<br>Trần Đại Lâm, Vật liệu nano sinh học, NXB Khoa học tự nhiên và Công nghệ, Hà Nội, 2015 |

## 66. Biomedical Material Fabrication Practices

| **Module designation** | **Biomedical Material Fabrication Practices** , MSC10320 |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Ta Thi Kieu Hanh, Cao Thi My Dung, Nguyen Duc Hao, Dau Tran Anh Nguyet |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lab works, |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 0 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 90 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 | Knowledge: Apply methods of manufacturing and evaluating materials in experiments<br>Skill: Able to operate a number of materials manufacturing equipment in general and biomedical materials in particular. |
| Content | Lesson 1: Fabrication of chitosan microspheres using ionic gel generation method (10 hours)<br>Lesson 2: Investigating the protein loading capacity of chitosan microspheres (10 hours)<br>Lesson 3: Manufacturing hydroxyapatite (HA) biomedical ceramics (10 hours) |

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| | Lesson 4: Investigating the biocompatibility of Hydroxyapatite (HA) biomedical ceramics in SBF pseudo-solution environment (10 hours)<br>Lesson 5: Fabrication of Fe3O4@SiO2 material system with porous structure (20 hours)<br>Lesson 7: Fabrication of luminescent nano powder NaYF4 doped with rare earth ions Er, Yb (10 hours)<br>Lesson 8: Surface modification of nanoparticles with poly acrylic acid (PAA) (10 hours) |
| Examination forms | Lab works: 30 %<br>Experiment report: 30%<br>Final exam: 40% |
| Study and examination requirements | Attendance of lab works is about 100%<br>Complete experiment report and pas the final exam. |
| Reading list | Practice manufacturing biomedical materials (internal circulation) |

## 67. **Biochemical Laboratory**

| **Module designation** | **Biochemical Laboratory**, MSC10314 |
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| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Đậu Trần Ánh Nguyệt |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | lab works |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 0 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 60 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 provides students with hands-on skills in Chemistry: techniques for extracting organic compounds by distillation and chromatography; reaction techniques, skills for observing, identifying, and preparing chemical compounds in the laboratory; and at the same time helps students apply knowledge of chemistry to explain phenomena occurring in experiments.<br>After completing this course, the students will be able to:<br>- Apply basic knowledge of chemistry to experiments and vice versa (3) |

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| | - Practice some techniques of extraction, isolation and purification of organic compounds; determine physical and chemical quantities of colloidal systems; techniques of conducting chemical reactions to illustrate properties, identify, prepare compounds and qualitatively analyze ions in solutions (3)<br>- Practice laboratory works and techniques of conducting chemical reactions (3)<br>- Have the ability to self-assess knowledge and self-study for life (2) |
| Content | In this course, students will (1) practice techniques for extracting organic compounds by distillation or chromatography; (2) perform experiments to illustrate properties and identify compounds through inorganic chemical reactions, such as acid-base reactions, oxidation-reduction reactions, complex formation reactions) and (3) prepare some typical compounds. |
| Examination forms | Essay |
| Study and examination requirements | 100% class attendance, Total score greater than or equal to 5 |
| Reading list | Chemistry Laboratory TechniquesTextbook<br>(Internal Circulation) |

## 68. Biological Property Assessment of Materials

| **Module designation** | **Biological Property Assessment of Materials**, MSC10315 |
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| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Từ Thị Trâm Anh |
| Language | Vietnamese |
| Relation to curriculum | Compulsory Biomedical Materials Specialization |
| Teaching methods | Lab works |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 0 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 60 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 4 ECTS |
| Required and recommended prerequisites for joining the module | BIO00001 General Biology 1 |
| Module objectives/intended learning outcomes | Module objectives:<br>After completing this course, students can extract, preserve, and amplify DNA; measure the quality and quantity of DNA and proteins; evaluate the bactericidal, antibacterial, and cytotoxic properties of biomedical materials.<br>Knowledge:<br>- Distinguishing the properties of biological molecules<br>- Applying knowledge of molecular biology to explain the principles of nucleic acid extraction, collection and cloning |

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| | - Evaluating the quality and quantity of nucleic acids and proteins in the sample.<br>- Determining the antibacterial, bacteriostatic and cytotoxic effects of materials.<br>Skills:<br>- Extract, preserve, and amplify biological molecules<br>- Perform experimental procedures to determine the quality and quantity of biological molecules in samples<br>- Perform antibacterial, bacteriostatic, and cytotoxicity testing procedures<br>- Ensure safety of biological experiments.<br>Learning outcomes<br>Knowledge:<br>- Distinguishing the structure and properties of DNA, proteins, and enzymes. Applying knowledge about DNA to explain the principles of DNA extraction and storage methods.<br>- Explaining the principles of DNA amplification using polymerase chain reaction (PCR)<br>- Explaining the principles of agarose gel electrophoresis<br>- Determining the relationship between the quality and quantity of nucleic acids and the optical density of the bands on agarose gels<br>- Explaining the principles of protein quantification using the biuret method<br>- Summarizing the process of separating DNA and proteins using agarose gel electrophoresis<br>- Explaining the principles of analyzing the antibacterial properties of materials using the agar diffusion method<br>- Summarizing the experimental process of analyzing the antibacterial properties of materials using the agar diffusion method |

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| | - Determining the relationship between the diameter of the antibacterial ring and the antibacterial effectiveness of materials<br>- Explaining the principles of methods for analyzing the antibacterial properties of materials<br>- Summarizing the experimental process of analyzing the antibacterial properties of materials<br>- Determining relationship between bacterial density under the material membrane and the antibacterial effect of the material<br>- Explain the principles of the methods for analyzing the cytotoxicity of materials<br>- Summary of the experimental procedure for analyzing the cytotoxicity of materials<br>- Choosing suitable controls for the tests.<br>Skills:<br>- Extract total DNA<br>- Amplify DNA by PCR<br>- Separate DNA and protein by agarose electrophoresis<br>- Display DNA bands on agarose gel<br>- Quantify protein<br>- Perform aseptic operations<br>- Perform agar plate inoculation<br>- Display antibacterial ring results from agar diffusion testing in the report<br>- Conduct antibacterial resistance testing<br>- Perform material and cell suspension and reagents in wells according to the procedure<br>- Comply with safety principles in biological laboratories. |
| Content | Lesson 1: Laboratory regulations And instructions for using tools and equipment in the laboratory (2 hours)<br>Lesson 2: Nucleic acid extraction (8 hours) |

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| | Lesson 3: PCR (Polymerase Chain Reaction) technique (8 hours)<br>Lesson 4: Agarose gel electrophoresis and DNA analysis (8 hours)<br>Lesson 5: Qualitative and quantitative protein analysis (8 hours)<br>Lesson 6: Testing antibacterial activity by agar diffusion method (8 hours)<br>Lesson 7 Testing antibacterial activity (8 hours)<br>Lesson 8 Testing the cytotoxicity of materials (8 hours)<br>Review (2 hours) |
| Examination forms | Attendance and attitude during practice sessions: regular test<br>Practical skills: The ability to perform experiments, technical procedures, or practical exercises correctly according to the process and requirements.<br>Reports or reflections: Writing reports, |
| Study and examination requirements | Total grade is equal or higher than 5 and attend 100 percent class. |
| Reading list | Hồ Huỳnh Thùy Dương, Trần Lê Sơn, Practice Molecular Biology, Ho Chi Minh City National University Publisher.<br>Trần Linh Thước, Nguyễn Đức Hoàng. Phan Thị Phương Trang, Phạm Thị Hồng Tươi, Practice Microbiology, Ho Chi Minh City National University Publis |

## 69. Cancer treatment by immunological technique

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| **Module designation** | **Cancer treatment by immunological technique** , MSC10317 |
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Từ Thị Trâm Anh |
| Language | Vietnamese |
| Relation to curriculum | Elective, Biomedical Materials Specialization |
| Teaching methods | lecture, lesson |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 | Module objectives:<br>After completing this course, students will be able to understand the power of the immune system, how new immunotherapies are changing cancer treatment, and how nanomaterials enhance the therapeutic efficacy of immunotherapies.<br>Knowledge:<br>- Differentiating immunotherapeutic strategies in cancer treatment. |

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| | - Analyzing how nanomaterials enhance the effectiveness of immunotherapy-based cancer treatment.<br>Skills:<br>- Ability to think independently to solve problems related to immunotherapy in cancer treatment.<br>Learning outcomes:<br>Knowledge:<br>- Summary of components of the immune system involved in cancer therapy.<br>- Compare types of immunotherapy including: immune checkpoint inhibitors, T cell transfer therapy, monoclonal antibodies, cancer vaccines, immune modulation.<br>- Analyze how nanomaterials enable precise delivery of immunomodulatory drugs, enhance the efficacy of cancer vaccines, and directly enhance immune cell activity.<br>Skills:<br>- Presentation to the crowd of models of immunotherapy strategies for cancer treatment. |
| Content | Chapter 1: Components of the Immune System Relevant to Cancer Therapy<br>Lesson 1.1. Immune System Cells and Their Roles (2 hours)<br>Lesson 1.2. Signaling Molecules, Co-Stimulators, and Co-Inhibitors (2 hours)<br>Chapter 2: Immunotherapy Strategies<br>Lesson 2.1. Immune Checkpoint Inhibition (4 hours)<br>Lesson 2.2. T-Cell Transfer Therapy (2 hours)<br>Lesson 2.3. Monoclonal Antibodies (2 hours)<br>Lesson 2.4. Cancer Vaccines (2 hours)<br>Lesson 2.5. Immune System Modulation (2 hours)<br>Chapter 3. Nanomaterials Enhance the Efficacy of Immunotherapy-Based Cancer Treatment<br>Lesson 3.1. Nanomaterials Deliver Targeted Immunomodulatory Drugs (4 hours) |

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| | Lesson 3.2. Nanomaterials Enhance the Efficacy of Cancer Vaccines (4 hours)<br>Lesson 3.3. Nanomaterials Directly Enhance the Activity of Immune Cells (4 hours)<br>Review (2 hours) |
| Examination forms | Mid-term Exam: written essay<br>Final Exam: written essay |
| Study and examination requirements | Total grade equal or highre than 5.0 (10-point scale) |
| Reading list | Nima Rezaei, Cancer Immunology: Bench to Bedside Immunotherapy of Cancers, Springer Nature, 2020. |

## 70. Drug Delivery Materials

| **Module designation** | **Drug Delivery Materials** , MSC10318 |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Ta Thi Kieu Hanh, Doan Le Hoang Tan |
| Language | Vietnamese |
| Relation to curriculum | Elective, Biomedical Materials Specialization |
| Teaching methods | Lecture, seminar, project |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 | Knowledge: Apply knowledge of medicinal chemistry, drugs and drug delivery techniques.<br>Skills: Able to learn English documents related to materials and pharmaceutical chemistry |
| Content | Chapter 1: General of medicinal chemistry (2,5 hours)<br>Chapter 2: Medicines (5 hours)<br>Chapter 3: Introduction to drug delivery (7,5 hours)<br>Chapter 4: Drug delivery techniques (5 hours)<br>Chapter 5: Drug delivery materials (10 hours) |

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| Examination forms | Seminar: 20%<br>Project: 20%<br>Final exam: 60 % |
| Study and examination requirements | Minimum attendance of lecture is about 80%<br>Complete all required exercises and actively contribute to the construction of the lesson |
| Reading list | 1. Drug Delivery: Principles and Applications (2005), Jonh Wiley & Sons<br>2. Drug Delivery: Engineering Principles for Drug Therapy (2001), Oxford University Press |

## 71. Chemical defects in Materials

| **Module designation** | **Chemical defects in Materials**, MSC10101 |
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| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Dr. Trần Công Khánh |
| Language | Vietnamese |
| Relation to curriculum | Compulsory, Thin Film Materials Specialization |
| Teaching methods | Lecturing, Discussion, Exercise, Q&A |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 22.5 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 3.25 ECTS |
| Required and recommended prerequisites for joining the module | Specialized subjects |
| Module objectives/intended learning outcomes | General objective: This course provides students with a general understanding of defects in crystalline compounds, classification of intrinsic and extrinsic defects, thermodynamic diagrams related to defects, transmission mechanisms and diffusion of defects in solids. In addition, students also can analyze the role of defects in study of materials and some specific applications. |
| Content | Lesson 1: Introduction to structure and defects. Lesson 2-3: Defect reactions, Thermdynamics and point defects. Lesson 4-5: Impurities and dopants. Lesson 6: Phase diagrams of compounds. Lesson 7-8: Analysis methods for determination |

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| | of defects in materials. Lesson 9. Diffusion. Lesson 10: Applications of "Chemical Defects". |
| Examination forms | Oral presentation, essay, discussion, attendance. |
| Study and examination requirements | Total score greater than or equal to 5. |
| Reading list | Đỗ Quang Minh, Hóa học chất rắn, NXB Đại học Quốc gia TP.Hồ Chí Minh, 2009.<br>Per Kofstad and Truls Norby, Defects and Transport in Crystalline solids, University of Oslo, 2007.<br>Richard J. D. Tilley, Defects in solids, John Wiley and Son, 2008. |

## 72. Micro And Nano Electronic Engineering

| **Module designation** | **Micro And Nano Electronic Engineering**, MST10109 |
|---|---|
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Dr. Vinh Quang Dang |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Discussion, Practice, Q&A |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 37.5 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours: 90<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 4.75 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, and |

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| | LIGA technology. Furthermore, it provides students with knowledge about packaging technology. |
| Content | Lesson 1: General the lithography techniques.<br>Lesson 2: Photolithography<br>Lesson 3: Ebeam lihtography.<br>Lesson 4: Soft lithography.<br>Lesson 5: Nanoimprint lithography.<br>Lesson 6: Dip pen lithography<br>Lesson 7: Ethcing technique<br>Lesson 8: Vacuum technique<br>Lesson 9: Surface Micromachining, LIGA techniques<br>Lesson 10: Bulk Micromachining<br>Lesson 11: Other applications of MEMS: Microrobots, micro-optical devices, RF MEMS… |
| 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<br>2. An introduction to Microelectromechanical system Engineering, Nadim Maluf, Kirt Williams, Artech House, Inc, 2004<br>3. Microsensors, MEMS, and Smart Devices, Julian W. Gardner, Vijay K. Varadan, Osama O. Awadelkarim, 2001<br>4. Micro Electro Mechanical System Design, James J. Allen, 2005 |

## 73. Practical Methods for Material Analysis 1

| **Module designation** | **Practical Methods for Material Analysis 1**, MSC10103 |
|---|---|
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Dr. Dang Vinh Quang, Dr. La Phan Phuong Ha, Dr. Nguyen Ho Thuy Linh, Dr. Mai Ngoc Xuan Dat, Dr. Le Khac Top, Dr. Tran Cong Khanh |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Discussion, Practice, Q&A |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 0 hour(s)<br>Practice: 60 hour(s)<br>Self-study: 120 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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: This course provides students with knowledge and skills in the synthesis and analysis of nanostructured materials in the form of nanoparticles, nanotubes, nanorods; applying methods of fabrication and analysis of advanced materials. This course will help students to have the knowledge and skills needed to conduct graduation thesis / seminar as well as in the working process in the future. |
| Content | Lesson 1: Practice solvothermal synthesis of VOx nanotubes. Lesson 2: Fabricate ZnO nanorods by sol-gel method. Lesson |

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| | 3: Fabricate the ZnO nanoparticles by coprecipitation method. Lesson 4: Practice the FT-IR analysis method. Lesson 5: Practice the XRD analysis method. Lesson 6: Practice the TGA analysis method |
| Examination forms | Lab work, essay, attendance. |
| Study and examination requirements | Total score greater than or equal to 5. |
| Reading list | Practice text in Materials Synthesis and Characterization Laboratory 1 (Faculty of Materials Science and Technology).<br>Lectures in Materials Fabrication 1,2; Materials Characterization 1,2 |

## 74. Surface and Interface Science of Solids

| **Module designation** | **Surface and Interface Science of Solids**, MSC10107 |
|---|---|
| Semester(s) in which the module is taught | 6th 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:<br>Lecture: 22.5 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 Chemistry 1, General Materials Science, Fundamentals of Solid State Science |
| Module objectives/intended learning outcomes | The central focus of this course is to explain the fundamental theory and principles of surface science. It provides an understanding of surface phenomena at the atomic and molecular levels and their relationship to surface properties and processes, which are critical in nanotechnology and nanomaterials.<br>Upon successful completion of the course the student will be able to:<br>1. Recall the simple atomic structures of crystalline low-index surfaces. |

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| | 2. Understand the origins of the relaxation or reconstruction behavior of clean and adsorbed surfaces<br>3. Utilize surface analysis methods to characterize the surface properties of materials and interpret the results.<br>4. Establish the relationship between atomic and electronic structures of surface and the general properties of materials |
| Content | 1. Introduction: Surface science and its subjects (1.5 hours)<br>2. Atomic structures of crystalline surfaces (6 hours)<br>3. Relaxation and reconstruction of clean and adsorbed surfaces (6 hours)<br>4. Adsorption and chemical reactions on surfaces (6 hours)<br>5. Surface analysis I: Diffraction methods (6 hours)<br>6. Surface analysis II: Electron spectroscopy methods (6 hours)<br>7. The electronic structure of surfaces (6 hours) |
| Examination forms | Assessment, Discussion, Write exam |
| Study and examination requirements | 50 % |
| Reading list | Vật liệu màng mỏng1. K. Oura, V.G. Lifshits, A.A. Saranin, A.V. Zotov, and M. Katayama, Surface Science – An Introduction, Springer, 2003<br>2. Dr. Michel A. Van Hove Professor William H. Weinberg Dr. Chi-Ming Chan, Low Energy Electron Diffraction: Experiment Theory |

## 75. Thin-Film Physics

| **Module designation** | **Thin Film Physics** , MSC10105 |
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| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Pham Kim Ngoc |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | lecture, seminar, homework |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 37.5 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 4.75 ECTS |
| Required and recommended prerequisites for joining the module | Fundamental of solid state science; Thermodynamic of materials, Method of fabrication materials 2, Method of characterization materials |
| Module objectives/intended learning outcomes | Knowledge: Identify concepts and basic characteristics of thin film materials and application areas. Explain the dynamic processes and mechanisms of thin film formation and growth. Select and apply thin film fabrication methods. Classify methods for analyzing thin film materials and select the appropriate method for each material<br>Skill: Be able to identify and evaluate factors affecting the thin film manufacturing/analysis process |
| Content | Chapter 1: Introduction of thin films (Definition, Characteristics, Properties and Applications) |

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| | Chapter 2: Basics of thin film physics (Kinetics, Thermodynamics)<br>Chapter 3: Formation and growth of thin film (Nucleation, Diffusion, Structural growth models, Adhesion, Stress...)<br>Chapter 4: Thin film fabrication (PVD, CVD, solgel)<br>Chapter 5: Analysis methods (structure, morphology, properties of thin films) |
| Examination forms | Mid exam, Homework, Final exam, Seminar |
| Study and examination requirements | Final score: 5 |
| Reading list | Nguyễn Hữu Chí, Giáo trình vật lý màng mỏng, NXB ĐHQG HCM, 2004<br>Nguyễn Năng Định, Vật lý và kỹ thuật màng mỏng, NXB ĐHQG HN, |

## 76. Computational Materials

| **Module designation** | **Computational Materials** , MSC10108 |
|---|---|
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Vu Hoang Nam, Tran Thi Minh Thu |
| Language | Vietnamese |
| Relation to curriculum | Compulsory |
| Teaching methods | Lecture, Lab works, Project |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 22.5 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 Chemistry 1, General Materials Science, Fundamentals of Solid State Science, Thermodynamics of Materials |
| Module objectives/intended learning outcomes | This course will provide fundamental knowledge of the theoretical foundations, including molecular dynamics and density functional theory, as well as modeling and simulation techniques for various types of solid materials and biological systems at the atomic and electronic structure levels. This knowledge will facilitate an understanding of the structure of solid materials and biological systems and their relationship with their properties.<br>Upon successful completion of the course the student will be able to: |

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| | 1. Understand the role of computational materials science in the research of condensed matter and biological systems.<br>2. Understand, distinguish, and interpret the theoretical fundamentals of classical molecular dynamics and density functional theory.<br>3. Construct the material structure at the atomic scale using computer simulations.<br>4. Utilize computational tools to simulate material models.<br>5. Analyze and evaluate the stability and feasibility of the simulated models. |
| Content | 1. Introduction to modeling and simulation (1 hour)<br>2. First principles of quantum mechanics and density functional theory (6 hours)<br>3. Molecular dynamics theory (6 hours)<br>4. Constructing models of solid materials and biological systems (4 hours)<br>5. Using simulation software on computers (4 hours)<br>6. Analyzing and evaluating the stability and feasibility of the simulated model (3 hours)<br>7. Analyzing and evaluating the properties of the simulated model (3 hours)<br>8. Report projects (3 hours) |
| Examination forms | Assessment, Oral presentation |
| Study and examination requirements | 50 % |
| Reading list | 1. D. C. Rapaport, The art of molecular dynamics simulation. Cambridge university press, (2004)<br>2. J.M. Haile, (1997) Molecular Dynamics Simulation: Elementary Methods, Wiley<br>3. R. M. Dreizler and E. K. U. Gross, Density Functional Theory: An Approach to |

## 77. Surface functionalization of materials

| **Module designation** | **Surface functionalization of materials**, MSC10110 |
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| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | La Phan Phương Hạ |
| Language | Vietnamese |
| Relation to curriculum | Compulsory Thin Film Materials Specialization |
| Teaching methods | Thuyết giảng + seminar + thảo luận |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 22.5 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 3.25 ECTS |
| Required and recommended prerequisites for joining the module | Thin Film Physics, Material Fabrication Methods |
| Module objectives/intended learning outcomes | This course equips students with fundamental knowledge of material surface modification techniques and their applications in industrial production, particularly in the biomedical field. Upon completion, students will be able to access, explore, and conduct in-depth research on material surface modification.<br>Additionally, throughout the course, students will develop teamwork skills, as well as skills in writing and presenting technical reports. This course also helps students recognize the significance of surface modification techniques and apply them effectively in real-world manufacturing. |

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| Content | □ Understand the concepts, requirements for material surfaces, classification, and selection of surface modification methods.<br>□ Analyze the composition and structure of modified surfaces.<br>□ Comprehend surface treatment methods in surface modification.<br>□ Understand coating-based surface modification techniques.<br>□ Apply acquired knowledge to explore research on material surface modification.<br>□ Work in teams to write and present technical reports. |
| Examination forms | Final exam + Seminar + Assignments |
| Study and examination requirements | Final scores >= 5 |
| Reading list | Surface Engineering: Surface Modification of Materials (Ram Kossowsky and Subhash C. Singhal). |

## 78. Materials and Devices for Energy storage

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| Module designation | **Materials and Devices for Energy storage**, MSC10111 |
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Dr. Tran Quang Minh Nhat |
| Language | Vietnamese |
| Relation to curriculum | Compulsory, Thin Film Materials Specialization |
| Teaching methods | Discussion, Practice, Q&A |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 22.5 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise 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 | To equip students with fundamental knowledge of the principles, materials, and applications of thermoelectric phenomena, as well as other key branches of materials science for energy conversion and storage. Upon completion of the course, students will understand the major thermoelectric effects, master the characteristics of suitable materials, analyze thermoelectric devices, conduct measurements of relevant properties, explore advanced materials, evaluate industry trends, and apply critical thinking to address challenges and anticipate future prospects. In addition, students will be introduced to essential |

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| | concepts and emerging technologies in related fields such as photovoltaics, hydrogen evolution reactions, supercapacitors, lithium-ion batteries, and next-generation battery systems. This comprehensive foundation will enable students to apply cross-disciplinary knowledge in energy conversion, thermal management, and environmental protection, as well as participate actively in research and innovation across various energy-related material systems. |
| Content | Lesson 1: Introduction to Energy Conversion from a Global Contemporary Perspective.<br>Lesson 1: Introduction to Photovoltaic Conversion.<br>Lesson 2: Characterization of Photovoltaic Parameters and Efficiency Evaluation.<br>Lesson 3: Supercapacitors and Performance Evaluation.<br>Lesson 4: Thermoelectric Component Analysis and Power Output Survey.<br>Lesson 5: Introduction to Modern Energy Storage Technologies from a Materials Science Perspective.<br>Perspective.Lesson 6: Lithium battery and advanced battery technology. |
| Examination forms | Midterm exam (20%)<br>Class assignment (30%)<br>Final exam (50%) |
| Study and examination requirements | Total score greater than or equal to 5. |
| Reading list | J. A. Kilner, Functional Materials for Sustainable Energy Applications: From Materials to Devices, Wiley, 2011. D. M. Rowe, Thermoelectrics and Its Energy Harvesting, CRC Press, 2012. Francois Beguin, Supercapacitors: Materials, Systems, and Applications , Wiley-VCH (2013) |

## 79. Fuel Cells

| **Module designation** | **Fuel Cells** , MSC10113 |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Tran Duy Tap, PhD |
| Language | Vietnamese |
| Relation to curriculum | Compulsory, Thin Film Materials Specialization |
| Teaching methods | Lecture, Q&A, Seminar |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 3 ECTS |
| Required and recommended prerequisites for joining the module | No recommended prerequisites |
| Module objectives/intended learning outcomes | Recognize and understand the impact of energy on science and technology. Understand the importance of energy storage. Master the principles of structure and operation of fuel cells. Understand the applications of fuel cells. Understand methods for evaluating fuel cell material properties. Understand methods for structural evaluation of fuel cell materials. Ability to identify, analyze influencing factors and evaluate a problem related to fuel cells. Teamwork. Improve the ability to read and understand professional documents of the subject. |

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| Content | Energy storage and conversion. Principle of structure and operation of fuel cells. Fuel cell applications. Fuel cell materials. Methods for evaluating fuel cell material properties. Methods for evaluating the structure of fuel cell materials. |
| Examination forms | Diligence (10%), Discussion or Exercise (10%), Midterm exam (30%), Final exam (50%) |
| Study and examination requirements | Test score greater than or equal to 5 |
| Reading list | Tran Duy Tap, Shin-ichi Sawada, Shin Hasegawa, Yosuke Katsumura, and Yasunari Maekawa, Poly(ethylene-co-tetrafluoroethylene) (ETFE)-based graft-type polymer electrolyte membranes with different ion exchange capacitieswith various IEC: Relative humidity de |

## 80. Materials synthesis and Characterization Laboratory 2

| **Module designation** | **Materials synthesis and Characterization Laboratory 2** , MSC10104 |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Pham Kim Ngoc |
| Language | Vietnamese |
| Relation to curriculum | Compulsory Thin Film Materials Specialization |
| Teaching methods | Lab work |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 0 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 60 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 4 ECTS |
| Required and recommended prerequisites for joining the module | Materials Synthesis Methods 2, Lab work on Materials Synthesis, Materials Characterization Techniques 1, Materials Characterization Techniques 2, Thin film Physics, Micro and NanoElectronic Engineering. |
| Module objectives/intended learning outcomes | Knowledge: Explain the working principle of vacuum pumps, the principles of fabrication methods and materials analysis methods. Practice disassembling the vacuum pump system, fabricating thin films by evaporation, sputtering; material hardness analysis, I-V characteristic, Hall effect.<br>Skill: Have skills for personal work and for presenting personal reports. Skill in team work and group report presentation. Evaluate and respond to the results of sample |

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| | fabrication and material properties measurement. Predict possible situations during the implementation. |
| Content | Lab work 1: Practice disassembly of the vacuum pump system<br>Lab work 2: Practice fabricating thin films by the sputtering method<br>Lab work 3: Practice fabricating thin films by solution method<br>Lab work 4: Analysis of hardness by Vicker method<br>Lab work 5: Analysis of Hall effect of semiconductor film<br>Lab work 6: Analysis of I-V characteristics |
| Examination forms | Report |
| Study and examination requirements | Final score: 5 |
| Reading list | Practice texbook, Lecturers in charge. |

## 81. Sound-thermal insulation and mechanical materials

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|---|---|
| **Module designation** | **Sound-thermal insulation and mechanical materials**, MSC10112 |
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | La Phan Phương Hạ, Lê Thái Duy |
| Language | Vietnamese |
| Relation to curriculum | Elective, Thin Film Materials Specialization |
| Teaching methods | Thuyết giảng + seminar + bài tập |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 3 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 the classification, characteristics, properties, fabrication methods, and evaluation of soundproofing, thermal insulation, and mechanical materials. |
| Content | Describe the basic characteristics and properties of soundproofing, thermal insulation, and mechanical materials.<br>Differentiate and compare the properties of various types of soundproofing, thermal insulation, and mechanical materials. |

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| | Develop skills in searching for literature, reading, analyzing, and reporting statistical data related to soundproofing, thermal insulation, and mechanical materials.<br>Enhance teamwork, discussion, research, and presentation skills on practical applications of soundproofing, thermal insulation, and mechanical materials. |
| Examination forms | Final exam, midterm exam, seminar |
| Study and examination requirements | Total scores >= 5 |
| Reading list | TCFrancis Weston Sears, University physics: mechanics, heat, and sound, Mark. W Zemansky, Massachusetts: Addison-Wesley |

## 82. Gas sensor materials

| **Module designation** | **Gas sensor materials** , MSC10114 |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | La Phan Phương Hạ |
| Language | Vietnamese |
| Relation to curriculum | Elective, Thin Film Materials Specialization |
| Teaching methods | Thuyết giảng + seminar + bài tập |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 3 ECTS |
| Required and recommended prerequisites for joining the module | Semiconductor physics, General Materials Science |
| Module objectives/intended learning outcomes | This course provides students with fundamental knowledge of gas sensors and various materials used in gas sensor fabrication.<br>It covers the basic principles, structure, and operation of gas sensor systems, along with specific examples of nanostructured materials applied in gas sensing technology. |
| Content | Understand the structure and working principles of gas sensor systems.<br>Grasp the factors affecting the properties of gas sensor systems. |

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| | Acquire knowledge of various nanostructured materials used in gas sensor applications.<br>Develop skills in reading and comprehending technical documents.<br>Work individually and collaboratively in teams to prepare and present reports on specialized topics. |
| Examination forms | Homework, midterm exam, final exam |
| Study and examination requirements | Total score >= 5 |
| Reading list | Jacob Fraden (Handbook of modern sensors)<br>Lê Chí Kiên (Giáo trình Đo lường cảm biến) |

## 83. Photocatalytic Materials

| **Module designation** | **Photocatalytic Materials** , MSC10115 |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Le Khac Top |
| Language | Vietnamese |
| Relation to curriculum | Elective, Thin Film Materials Specialization |
| Teaching methods | lecture and seminar |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 | 2, 3, 4 Bloom level |
| Content | 5 Chapters |
| Examination forms | Final exame, Seminar, and Discussion |
| Study and examination requirements | 5/10 points |
| Reading list | Photocatalysis Fundamentals, Materials and Applications, Photocatalytic Reaction Engineering, Photocatalysis: From Fundamental Principles to Materials and |

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| | Applications, Visible-light photocatalysts: Prospects and challenges |

## 84. Electrical Memory Materials and Devices

| **Module designation** | **Electrical Memory Materials and Devices**, MSC10116 |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Pham Kim Ngoc |
| Language | Vietnamese |
| Relation to curriculum | Elective |
| Teaching methods | Lecture, Seminar, Homework |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 22.5 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 3.25 ECTS |
| Required and recommended prerequisites for joining the module | Công nghệ vi điện tử micro-nano, Các phương pháp chế tạo vật liệu 1,2 và Các phương pháp phân tích vật liệu 1, 2 |
| Module objectives/intended learning outcomes | Knowledge: Classify types of electronic memory and data storage memories. Determine the parameters and basic characteristics of data storage memories. Describe and compare the structure and characteristics of traditional and emerging memory types.<br>Skill: Ability to search documents, read and select necessary information related to subject content |
| Content | Chapter 1: Introduction of data storage memories (Classification, Characteristics, Applications and Development) |

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| | Chapter 2: Traditional memories: Structure, Features and Application (ROM, SRAM, DRAM, Flash)<br>Chapter 3: Emerging memories: Structure, Features and Application (PRAM, FeRAM, MRAM, RRAM).<br>Chapter 4: Neuromorphic computing, Supercomputing, Quantum computing. |
| Examination forms | Seminar, Homework, Final exam |
| Study and examination requirements | Final score: 5 |
| Reading list | 1. Wen-Chang Chen, Electrical Memory Materials and Devices, RSC, 2015<br>2. Tseung-Yuen Tseng and Simon M. Sze, Nonvolatile Memories -Materials, Devices and Applications, American Scientific Publishers, 2012 |

## 85. Applications of Radiation Technology in Materials Science

| **Module designation** | **Applications of Radiation Technology in Materials Science** , MSC10118 |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Trần Duy Tập |
| Language | Vietnamese |
| Relation to curriculum | Elective, Thin Film Materials Specialization |
| Teaching methods | Presentations, discussions, Teaching through topics and scientific articles |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 | General objective: Radiation technology (X-rays, electrons, neutrons, positrons, etc.) has many outstanding advantages in materials science compared to other physicochemical methods due to its great penetration ability, performed at room temperature, does not require additional reagents, and can be performed at the same time on a large scale with different materials. The course Application of radiation technology in materials science provides students with knowledge and skills related to the concept of radiation, the |

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| | mechanism of interaction of radiation with materials, synthesis methods, denaturation and analysis of materials using radiation technology. The course helps students understand and describe the above mentioned contents in order to apply, design, propose, and apply radiation technology in materials science. Learning outcomes: Distinguish and explain concepts, physical mechanisms and factors affecting the synthesis, modification and analysis of materials using radiation technology. Evaluate factors affecting the synthesis, modification and analysis of materials using radiation technology. Propose applications of radiation technology in a number of 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: Interaction of radiation with materials. Chapter 2: Application of radiation in materials synthesis. Chapter 3: Application of radiation in material modification. Chapter 4: Radiation applications in materials characterization. |
| Examination forms | Seminar, Discussion, Attendance |
| Study and examination requirements | Total score greater than or equal to 5. |
| Reading list | Trần Đại Nghiệp, Giáo trình xử lý bức xạ và cơ sở của công nghệ bức xạ, NXB Đại học quốc gia Hà Nội, 2006. Nguyễn Quốc Hiến, Công nghệ bức xạ biến tính vật liệu polymer, NXB Đại Học Quốc Gia TP Hồ Chí Minh, 2017. |

## 86. Smart Materials and Applications

| **Module designation** | **Smart materials and applications, MSC10119** |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Assoc. Prof. Dr. Tran Duy Tap |
| Language | Vietnamese |
| Relation to curriculum | Elective,Thin Film Materials Specialization |
| Teaching methods | Discussion, Practice, Q&A |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours: 90<br>1 lecture hour = 2.0 self-study hours<br>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, Materials Synthesis Methods 1-2 |
| Module objectives/intended learning outcomes | Smart materials are increasingly being widely used in electronic devices, computers, means of communication, transportation, construction works, life sciences, and even smart cities, etc. The subject of Smart Materials and Applications provides students with knowledge and skills related to concepts, structures, properties, mechanisms or operating principles, synthesis and analysis methods, and applications of smart materials. The subject helps students |

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| | understand and describe the responses or responses of smart materials to environmental stimuli, thereby applying, designing, synthesizing, proposing, and applying them in science and life. |
| Content | Lesson 1: Concept, classification, and characteristics of shape memory materials<br>Lesson 2: Shape memory mechanism of materials<br>Lesson 3: Factors affecting shape memory materials<br>Lesson 4: Applications of shape memory materials<br>Lesson 5: Concept, classification, and characteristics of self-healing materials<br>Lesson 6: How self-healing materials work<br>Lesson 7: Applications of self-healing materials<br>Lesson 8: Theoretical basis of electromechanical materials<br>Lesson 9: Working principle of electromechanical materials<br>Lesson 10: Applications of electromechanical materials<br>Lesson 11: Working principle of photochromic materials<br>Lesson 12: Some molecular structure model designs to improve performance, applications of photochromic materials |
| Examination forms | Oral presentation, essay, discussion, attendance. |
| Study and examination requirements | Total score greater than or equal to 5. |
| Reading list | 1. Jasprit Singh, Smart electronic materials – fundamental and application, Cambridge University Press, 2005.<br>2. Wen-Chang Chen, Electrical Memory Materials and Devices, RCS, 2015.<br>3. Myer Kutz, Smart materials, John Wiley & Sons, 2006. |

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| | 4. D. Michelle Addington, Daniel L. Schodek, Smart materials and new technologies for the architecture and design professions, 2005. |

## 87. Practice in computational materials

| **Module designation** | **Practice in computational materials, MSC10120** |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Dr. Tran Thi Minh Thu |
| Language | Vietnamese |
| Relation to curriculum | Elective, Thin Film Materials Specialization |
| Teaching methods | Lecture, lab works, project, seminar |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Practices: 60 hour(s)<br>Private study including examination preparation, specified in hours: 90 |
| Credit points | 4 ETCS |
| Required and recommended prerequisites for joining the module | Computational Material |
| Module objectives/intended learning outcomes | Knowledge: This course will help students perfect their simulation calculation skills and be able to completely simulate a material system.<br>Skills: Thereby helping students understand the structure of materials and the relationship with their properties. Competences: integration of knowledge, skills and social and methodological capacities in working or learning situations |
| Content | Chapter 1 (18 hours): Linux Operation System and Software for Simulation<br>Chapter 2 (18 hours): Materials Simulation<br>Chapter 3 (12 hours): Protein Simulation<br>Chapter 4 (12 hours): Project |

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| Examination forms | Project (50%)<br>Oral presentation (50%) |
| Study and examination requirements | Attendance at least 80%<br>Total mark >=5 |
| Reading list | 1. Computational Physics, 2006, Võ Văn Hoàng , Huỳnh Kim Lâm, Nguyễn Trung Hải, Nguyễn Hà Hùng Chương, HCMC-VNU Publishing<br>2. Understanding molecular simulations, 2002, Frenkel and Smit, Academic Press<br>3. Molecular Modeling and Simulation_ An Interdisciplinary Guide, Tamar Schlick, Springer, Second Edition, 2010. |

## 88. Specialization Seminar

| **Module designation** | **Specialization seminar, MSC10208** |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Assoc. Prof. Dr. Hoang Thi Dong Quy |
| Language | Vietnamese |
| Relation to curriculum | Compulsory, Polymer and Composite Materials Specialization |
| Teaching methods | Discussion, Present a scientific report in group |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 0 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 60 hour(s)<br>Private study including examination preparation, specified in hours: 0 hour<br>1 lecture hour = 2.0 self-study hours<br>1 exercise (lab) hour = 1.0 self-study hour |
| Credit points | 4 ECTS |
| Required and recommended prerequisites for joining the module | General materials science, Materials synthesis methods 1-2, Materials analyses 1-2 |
| Module objectives/intended learning outcomes | The purpose of this course is to train students to conduct meaningful research (basic, applied, or basic-applied research) in the area of materials synthesis and characterization and then produce a seminar topic. Students will work one-on-one/small group with their advisor throughout the process of completing the seminar. |
| Content | Lesson 1: Discuss the research topic |

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| | Lesson 2: Report research methodology, progress, and, factors that affect the quality of the research<br><br>Lesson 3: Analyze, interpret and report findings to advisor<br><br>Lesson 4: Discuss and finalize the research topic<br><br>Lesson 5: Present the scientific repost |
| Examination forms | Oral presentation |
| Study and examination requirements | Total score greater than or equal to 5. |
| Reading list | Scientific Journals and Books from Academic Publishers (Elsevier, Springer, Wiley, ACS,..) |

## 89. Smart polymer materials and applications

| **Module designation** | Smart polymer materials and applications, MSC10218 |
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| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Assoc. Prof. Dr. Tran Duy Tap |
| Language | Vietnamese |
| Relation to curriculum | Elective, Polymer and Composite Materials Specialization |
| Teaching methods | Discussion, Practice, Q&A |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours: 90<br>1 lecture hour = 2.0 self-study hours<br>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, Materials Synthesis Methods 1-2 |
| Module objectives/intended learning outcomes | • Smart polymer materials and applications provide students with knowledge and skills related to the concepts, structures, properties, mechanisms or operating principles, synthesis and analysis methods as well as applications of smart polymer materials. The subject helps students understand and describe the responses of smart polymer materials when there are environmental stimuli in order to apply, design, synthesize, propose, and apply them in science and life. The subject content is related to shape-memory polymer materials, self-healing polymer materials, polymer electromechanical materials, photochromic materials, and thermochromic materials. |

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| Content | • Lesson 1: Concept, classification, and characteristics of shape memory polymer materials<br>• Lesson 2: Shape memory mechanism of polymer materials<br>• Lesson 3: Factors affecting shape memory polymer materials<br>• Lesson 4: Applications of shape memory polymer materials<br>• Lesson 5: Concept, classification, and characteristics of self-healing polymer materials<br>• Lesson 6: Working principle of self-healing polymer materials<br>• Lesson 7: Applications of self-healing polymer materials<br>• Lesson 8: Theoretical basis of polymeric piezoelectric materials<br>• Lesson 9: Working principle of polymeric piezoelectric materials<br>• Lesson 10: Applications of polymeric piezoelectric materials<br>• Lesson 11: Working principle of photochromic materials<br>• Lesson 12: Some molecular structure model designs to improve performance<br>• Lesson 13: Applications of photochromic materials<br>• Lesson 14: Basic principle of thermochromic materials<br>• Lesson 15: Some molecular structure model designs to improve performance<br>• Lesson 15: Applications of thermochromic materials |
| Examination forms | Oral presentation, essay, discussion, attendance. |
| Study and examination requirements | Total score greater than or equal to 5. |
| Reading list | 1. Jasprit Singh, Smart electronic materials – fundamental and application, Cambridge University Press, 2005. |

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| | 2. Wen-Chang Chen, Electrical Memory Materials and Devices, RCS, 2015.<br><br>3. Myer Kutz, Smart materials, John Wiley & Sons, 2006.<br><br>4. D. Michelle Addington, Daniel L. Schodek, Smart materials and new technologies for the architecture and design professions, 2005. |

## 90. Polymer material for electronics and semiconductor

| **Module designation** | **Polymer material for micro-electronics and semiconductor, MSC10220** |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Assoc. Prof. Dr. Hoang Thi Dong Quy<br>Assoc. Prof. Dr. Tran Duy Tap<br>Dr. Nguyen Nguyen Ngan |
| Language | Vietnamese |
| Relation to curriculum | Compulsory, Polymer and Composite Materials Specialization |
| Teaching methods | Lecture, Discussion, Present a scientific report in group |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 22.5 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours: 60<br>1 lecture hour = 2.0 self-study hours<br>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, Materials synthesis methods 1-2, Materials analyses 1-2, Polymer and Composite materials |
| Module objectives/intended learning outcomes | General Objective: The general objective of the course is to provide learners with both fundamental and advanced competencies regarding the applications of advanced polymer materials in microelectronic and semiconductor devices.<br>Specific Objectives: To equip learners with both fundamental and advanced competencies to describe, present, explain, select, design, synthesize, or propose applications related to advanced polymer materials used in microelectronic and semiconductor devices. |

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| Content | Chapter 1: Introduction to Electronic Polymers<br>· The Concept and Classification of Electronic Polymers<br>· Polymers for Microelectronics and Nanoelectronics<br>· Physicochemical Properties of Electronic Polymers<br>Chapter 2: Introduction to Semiconducting Polymers<br>· The Concept and Classification of Semiconducting Polymers<br>· Polymers for Micro- and Nano-Semiconductors<br>· Physicochemical Properties of Semiconducting Polymers<br>Chapter 3: Polymers for the Microelectronics and Semiconductor Industry<br>· Electrical Conduction Models in Organic Polymer Materials<br>· Organic Polymers for Transistors (FET) / Random Access Memory (RAM)<br>· Organic Polymers for Light-Emitting Diodes (OLED) / Solar Cells<br>· Organic Polymer Materials in the Semiconductor Industry<br>· Organic Polymer Materials in the Microelectronics Industry |
| Examination forms | Oral presentation, essay, discussion, attendance. |
| Study and examination requirements | Total score greater than or equal to 5. |
| Reading list | 1. Rongjin Li, Wenping Hu, Yunqi Liu, Daoben Zhu, Micro- and Nanocrystals of Organic Semiconductors, ACS publisher 2010. |

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| | 2. Sulaiman Khalifeh, Polymers in Organic Electronics Polymer Selection for Electronic, Mechatronic & Optoelectronic Systems, Elsevier 2020.<br>3. Georges Hadziioannou, Paul F. van Hutten, Semiconducting Polymers Chemistry, Physics and Engineering, Wiley 2005. |

## 91. Dental Materials

| **Module designation** | **Dental Materials**, MSC10316 |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Assoc.Prof. Tran Thi Thanh Van, |
| Language | Vietnamese |
| Relation to curriculum | Elective, Biomedical Materials Specialization |
| Teaching methods | Discussion, Practice, Q&A |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 22.5 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 15 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 | This course aims to equip students with essential knowledge and practical understanding of dental materials commonly used in clinical dentistry. Upon completion, students will be able to:<br>• Understand the fundamental types, properties, and functions of materials used in restorative and prosthetic dentistry, including composites, amalgams, ceramics, cements, and implant materials. |

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| | • Analyze the mechanical, physical, chemical, and biological characteristics of dental materials and their influence on clinical performance.<br>• Establish correlations between material structure and functional outcomes in dental procedures.<br>• Apply critical thinking in selecting and using appropriate materials for various dental treatments.<br>• Recognize current advancements and innovations in the development of next-generation dental materials. |
| Content | Lesson 1: Composite resins<br>Lesson 2: Dental ceramics<br>Lesson 3: Amalgam<br>Lesson 4: Glass ionomer cement<br>Lesson 5: Titanium alloys |
| Examination forms | Multiple Choice, essay exam |
| Study and examination requirements | Total score greater than or equal to 5. |
| Reading list | John M. Powers, John C. Wataha, Dental Materials: Properties and Manipulation, Elsevier.<br>Kenneth J. Anusavice, Chiayi Shen, H. Ralph Rawls, Phillips' Science of Dental Materials, Elsevier |

## 92. Biosensors

| **Module designation** | **Biosensors**, MSC10321 |
|---|---|
| Semester(s) in which the module is taught | 7th semester |
| Person responsible for the module | Assoc. Prof. Lê Viết Hải. |
| Language | Vietnamese |
| Relation to curriculum | Elective, Biomedical Materials Specialization |
| Teaching methods | Discussion, Practice, Q&A |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 | General objective: This course equips students with basic knowledge about the structure, operating principles, specific parameters, manufacturing processes and applications of biosensors. After studying, students can approach, research and intensive research in the field of biosensors. In addition, in the learning process, students will improve their teamwork skills, writing and presenting thematic reports. In addition, this subject also helps students to be aware of the role and thereby apply biosensors to real life. |
| Content | Chapter 1: Overview of biosensors. Chapter 2: Biosensor construction. Chapter 3: Materials and technology in |

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| | manufacturing biosensors. Chapter 4: Immobilization methods. Chapter 5: Types of biosensors. Chapter 6: Application of biosensors. |
| Examination forms | Oral presentation, essay, discussion, attendance. |
| Study and examination requirements | Total score greater than or equal to 5. |
| Reading list | Tran Minh Canh, Biosensors, Chapman & Hall, 1993.<br>Sadana, Ajit, Engineering Biosensors - Kinetics and Design Applications, Publisher: Academic Press, 2002.<br>Trần Đại Lâm, Cảm biến sinh học điện hoá: Nguyên lý, vật liệu và ứng dụng, nxb Khoa học tự nhiên và Công nghệ, Hà Nội, 2014.<br>Trần Đại Lâm, Vật liệu nano sinh học, nxb Khoa học tự nhiên và Công nghệ, Hà Nội, 2015.<br>Trần Đại Lâm, Nguyễn Tuấn Dung, Nguyễn Lê Huy, Lê Viết Hải, Các phương pháp phân tích hoá lý vật liệu, nxb Khoa học tự nhiên và Công nghệ, Hà Nội, 2017. |

## 93. Learning with Enterprises

| **Module designation** | **Learning with Enterprises**, MSC10319 |
|---|---|
| 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, Biomedical Materials Specialization |
| Teaching methods | Discussion, Q&A |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 30 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 0 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 | General objective: Provide students with an overview of the research and application of various materials in societal life.<br>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.<br>Lesson 2: Overview of the adhesive process used in the footwear industry and future trends |

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| | Lesson 3: Technology of Jewelry and Gemstone Materials.<br>Lesson 4: Career Orientation<br>Lesson 5: Overview of the origin and production process of fabric, some basic mechanical-physical tests, and current applications in fabric production.<br>Lesson 6: Presentation skills.<br>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 |

## 94. Tissue Engineering

| **Module designation** | **Tissue Engineering,** MSC10312 |
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| 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, Biomedical Materials Specialization |
| Teaching methods | Discussion, Practice, Q&A |
| Workload (incl. contact hours, self-study hours) | (Estimated) Total workload:<br>Lecture: 22.5 hour(s)<br>Exercise: 15 hour(s)<br>Laboratory: 0 hour<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 1 self-study hour<br>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 |

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| | 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<br>Biomaterials<br>Regenerative biology |

## 95. Graduation thesis

| Module designation | Graduation thesis |
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| Semester(s) in which the module is taught | 8th semester |
| Person responsible for the module | HOANG Thi Dong Quy |
| 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:<br>Lecture: 0 hour(s)<br>Exercise: 0 hour(s)<br>Laboratory: 300 hour(s)<br>Private study including examination preparation, specified in hours:<br>1 lecture hour = 2.0 self-study hours<br>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 |

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| | 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<br>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<br>Total = 30% (Committee ) + 30% (Reviewer) + 40% (Advisor)<br>● Grade granted by the committee is the average of points given by all the members of the committee.<br>• Strictly follow the rules and regulations of the Laboratory |
| Reading list | Paper/Research in International/National Journals/Books |