

TRƯỜNG ĐẠI HỌC BÁCH KHOA HÀ NỘI
VIỆN KHOA HỌC VÀ KHOA HỌC VÀ KỸ THUẬT VẬT LIỆU

HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF MATERIALS SCIENCE AND ENGINEERING

CHƯƠNG TRÌNH ĐÀO TẠO
CỬ NHÂN

2020

BACHELOR PROGRAM 2020

CỬ NHÂN

KHOA HỌC VÀ KỸ THUẬT VẬT LIỆU

BACHELOR

IN MATERIALS SCIENCE AND ENGINEERING

CHƯƠNG TRÌNH ĐÀO TẠO
CỬ NHÂN
2020
NGÀNH
KỸ THUẬT VẬT LIỆU

**T/M Hội đồng xây dựng và phát
triển chương trình đào tạo**
Ngày.....tháng.....năm 2021
CHỦ TỊCH HỘI ĐỒNG

Phê duyệt ban hành
Ngày.....tháng.....năm 2021
HIỆU TRƯỞNG

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EDUCATION PROGRAM

Name of program: *Materials Science and Engineering*
Education level: *Bachelor (level 6)*
Major *Materials Science and Engineering*
Program code: *7520309*

Duration: *4.5 years (Bachelor 4 years)*
Degree *Bachelor in Materials Engineering*
Credits in total: *132 credits*

(Ban hành tại Quyết định số /QĐ-ĐHKB-ĐT ngày tháng năm 2021
của Hiệu trưởng Trường Đại học Bách khoa Hà Nội)

1. Program Goals

1.1 General objectives

- Training high quality human resources with the ability to create knowledge, new products for serving society and the country.
- Training learners with political and moral qualities; strong basic and professional knowledge, skills in professional practice, research capacity, and creative ability to solve problems related to the field of Materials Science and Engineering, adapted to the working environment, able to self-study to adapt to the continuous development of science and technology.

1.2 Specific objectives

The specific objectives of the Bachelor of Materials Science and Engineering to equip the learners with:

- Consistent knowledge of Materials Science and Engineering: basic knowledge of mathematics, physics, mechanics, statistics, physics, managements; Ability to apply background knowledge materials science and engineering, such as, thermodynamics and material kinetics processes, material mechanics, fabrication and processing of materials, structure and properties of materials in doing research and analysis of material system/process/product. Ability to apply material science and engineering knowledge to fabrication, shaping and processing; in combination with the ability to develop and imply modern methods and tools to design and evaluate the system/process/product solutions.
- Skills to apply knowledge, reasoning skills and system thinking to solve specialized issues in practice. Having appropriate attitude and professional ethics.
- Communication skills, team work skill, ability to use English efficiently and a professional working attitude suitable for a multidisciplinary and international collaboration environment.
- Ability to apply professional knowledge, formulate ideas, analyze, offer solutions to effectively solve problems consistently with actual socio-economic conditions.

2. Program Learning Outcomes

After graduation, the engineer in materials science and engineering program should acquire:

1. Consistent knowledge to adapt well various jobs such as research, development, consulting, management, and manufacturing in a wide range of Materials Science and Engineering:
 - 1.1. Ability to apply basic knowledge of mathematics, physics, mechanics, statistics, physical chemistry, administration to describe, calculate and simulate materials engineering systems/processes/products.
 - 1.2. Ability to apply background knowledge of materials science and engineering, such as, thermodynamics and material kinetics processes, material mechanics, fabrication and

processing of materials, structure and properties of materials in doing research and analysis of material system/process/product.

- 1.3. Ability to apply material science and engineering knowledge to fabrication, shaping and processing; in combination with the ability to develop and imply modern methods and tools to design and evaluate the system/process/product solutions.
2. Professional skills and personal qualities needed to succeed in careers:
 - 2.1. Technical problem analysis and solving, understanding the different approaches of the technology building process, appropriate for all aspects: socio-economic, professional ethics, law and information security.
 - 2.2. Experiment, research and discover knowledge ability.
 - 2.3. System thinking and critical thinking.
 - 2.4. Active, creative and serious.
 - 2.5. Ethics and professional responsibilities.
 - 2.6. Understanding contemporary issues and lifelong studying awareness.
3. Social skills needed to work effectively in multidisciplinary teams and in the international environment:
 - 3.1. Organizational, leadership and teamwork skills (multidisciplinary).
 - 3.2. Effective communication skills through writing, presentation, discussion, negotiation, case management, effective use of modern tools and facilities.
 - 3.3. Skills to use English effectively at work, TOEIC score ≥ 650 .
4. **Competence in design, development, implementation and maintenance of materials science and engineering systems, products and solutions in the economic, social and environmental context:**
 - 4.1. Awareness of the close relationship between materials science and engineering solutions with economic, social and environmental factors in the globalized world.
 - 4.2. Identify problems and formulate ideas of materials science and engineering solutions, build materials science and engineering projects.
 - 4.3. Design materials science and engineering systems, products and solutions.
 - 4.4. Implement and deploy materials science and engineering systems, products and solutions.
 - 4.5. Exploiting and maintaining materials science and engineering systems, products and solutions.

3. Program Content

3.1 General Program Structure

Professional component	Credit	Note
General Education	51	
Mathematics and basic sciences	32	Major oriented
Law and politics	13	in accordance with regulations of Vietnam Ministry of Education and Training
(Physical Education/ Military Education) Military Education is for Vietnamese student only.	-	
English	6	02 basic English courses
Professional Education	81	
Basic and Core of Engineering	48	
Soft skills	9	Include of 02 compulsory modules: Social/Start-up/other skill (6 credits); - Technical Writing and Presentation (3 credits).
Elective Module	16	Elective module provides specialized knowledge oriented towards different concentrations.
Engineering Practicum	2	scheduled for third year and beyond
Bachelor Thesis (or Design Project)	6	- Students register to carry out the Bachelor's thesis if they want to graduate from the bachelor's Degree. (conform to approved bachelor's degree program) - If students study integrated bachelor-master program, they will register for Research Thesis (MSE4989E) 8 credits instead of Engineering Practicum and Bachelor Thesis.
Research Thesis	8	Integrated Bachelor-Master program
Total	132 credits	

3.2 Course list & Standard schedule

No.	Course ID	Course Name	Credits	Semester								
				1	2	3	4	5	6	7	8	
BACHELOR'S DEGREE			132									
Laws and politics			13									
1	SSH1111	Introduction of the Marxist-Leninist Philosophy	3(2-1-0-6)	3								

No.	Course ID	Course Name	Credits	Semester									
				1	2	3	4	5	6	7	8		
2	SSH1121	Introduction of the Marxist-Leninist political economy	2(2-0-0-4)		2								
3	SSH1131	Scientific Socialism	2(2-0-0-4)			2							
4	SSH1141	Introduction of the Vietnam Communist Party History	2(2-0-0-4)				2						
5	SSH1151	The ideology of Ho Chi Minh	2(2-0-0-4)				2						
6	SSH1170	General Law	2(2-0-0-4)					2					
Physical Education													
7		Physical Education A	1(0-0-2-0)	x									
8		Physical Education B	1(0-0-2-0)		x								
9		Physical Education C	1(0-0-2-0)			x							
10		Physical Education D	1(0-0-2-0)				x						
11		Physical Education E	1(0-0-2-0)					x					
Military Education													
12	MIL1110	Vietnam Communist Party's Direction on the National Defense	3(3-0-0-6)		3								
13	MIL1120	Introduction to the National Defense	3(3-0-0-6)	3									
14	MIL1130	General Military Education	4(3-0-2-8)				4						
English			6										
15	FL1114	Grammar for writing	1(1-1-0-4)	x									
16	FL1115	English communication skills 1	1(1-1-0-4)	x									
17	FL1116	Skills integration 1	4(3-3-0-8)	x									
18	FL1117	Foundation writing for IELTS	1(1-1-0-4)	x									
19	FL1118	English communication skills 2	2(2-1-0-4)	x									
20	FL1119	Skills integration 2	4(3-2-0-8)	x									
21	FL1120	IELTS listening 1	2(2-1-0-4)		x								
22	FL1121	IELTS speaking 1	1(1-1-0-4)		x								
23	FL1122	IELTS reading 1	1(1-1-0-4)		x								
24	FL1123	IELTS writing 1	2(2-1-0-4)		x								
25	FL1124	IELTS listening 2	2(2-1-0-4)		x								
26	FL1125	IELTS speaking 2	1(1-1-0-4)		x								
27	FL1126	IELTS reading 2	1(1-1-0-4)		x								
28	FL1127	IELTS writing 2	2(2-1-0-4)		x								
29	FL2016	Writing Skills III	2(2-0-0-4)		x								
Mathematics and basic sciences			32										
30	MI1016	Calculus I	4(3-2-0-8)	4									
31	MI1026	Calculus II	4(3-2-0-8)		4								
32	MI1046	Differential equation and series	3(2-2-0-6)		3								

No.	Course ID	Course Name	Credits	Semester									
				1	2	3	4	5	6	7	8		
33	MI1036	Algebra	4(3-2-0-8)	4									
34	PH1016	Physics I	4(2-2-1-8)		4								
35	PH1026	Physics II	4(3-2-1-8)			4							
36	IT1016	Introduction to Computer Science	3(2-1-2-6)			3							
37	CH1016	General Chemistry	4(3-2-1-8)				4						
38	ME2016	Technical Drawing I	2(1-1-0-4)				2						
Basic Core of Engineering			48										
39	MSE1012	Introduction to engineering	2(2-1-0-4)		2								
40	MSE3206	Phases and phase relations	3(3-1-0-6)			3							
41	MSE3207	Materials Processing	3(3-0-0-6)				3						
42	MSE3407	Thermodynamics of Materials	3(3-0-0-6)				3						
43	MSE3416	Kinetic Processes in Materials	3(3-0-0-6)				3						
44	MSE3417	Material chemistry	2(2-0-0-4)				2						
45	MSE3456	Analysis of Data	3(3-0-0-6)				3						
46	MSE3126	Mechanics for materials	3(3-0-0-6)				3						
47	MSE3436	Microstructure Determination	3(2-1-1-4)					3					
48	MSE3427	Synthesis of Materials	2(2-0-0-4)					2					
49	MSE3317	Materials Laboratory 1	2(0-0-4-4)				2						
50	MSE4175	Solidification Processing	2(2-0-0-4)					2					
51	MSE3446	Thermal-mechanical behavior of materials	3(2-1-1-6)					3					
52	MSE3447	Electronic, optical and magnetic properties of Materials	3(2-2-0-6)					3					
53	MSE4156	Corrosion of Metals	3(3-0-0-6)					3					
54	MSE3326	Materials Laboratory 2	2(0-0-4-4)					2					
55	MSE4405	Materials Design	2(2-0-0-4)					2					
56	MSE4407	Smart Materials	2(2-0-0-4)					2					
57	MSE4408	Nanostructured materials	2(2-0-0-4)					2					
Soft skills			9			x	x	x	x				
58	EM1180E	Business Culture and Entrepreneurship	2(2-1-0-4)										
59	ED3280E	Applied Psychology	2(1-2-0-4)										
60	ED3220E	Soft Skills	2(1-2-0-4)										
61	ET3262E	Technology and Technical Design Thinking	2(1-2-0-4)										

No.	Course ID	Course Name	Credits	Semester									
				1	2	3	4	5	6	7	8		
62	MSE2024E	Technical Writing and Presentation	3(2-2-0-6)										
Elective courses			16					x	x	x	x		
62	MSE4015	Metal Processing	2(2-0-0-4)										
63	MSE4117	Design of Engineering Alloys	2(2-0-0-4)										
64	MSE4118	Composite Materials	2(2-0-0-4)										
65	MSE4119	Clean energy materials	2(2-0-0-4)										
67	MSE4651E	Amorphous Materials	2(2-1-0-4)										
66	MSE4652	Functional Materials	2(2-0-0-4)										
68	MSE4653	Atomic scale Simulation	2(2-0-0-4)										
69	MSE4654	Solid State Electronic Devices	2(2-0-0-4)										
70	MSE3161E	Materials for extreme conditions	2(2-0-0-4)										
71	MSE4655	Advanced ceramics	2(2-0-0-4)										
72	MSE4656	Surface and thin film technology	2(2-0-0-4)										
73	MSE4657	Nanobiomaterials Technology	2(2-0-0-4)										
74	MSE4658	Nanosensor and devices	2(2-0-0-4)										
75	MSE4659	Carbon nanotechnology	2(2-0-0-4)										
76	MSE3151E	Advanced Materials Processing	2(2-0-0-4)										
Bachelor Practicum and Thesis			8						x	x	x		
77	MSE4095E	Bachelor Practicum	2(0-0-4-4)						2				
78	MSE4999E	Bachelor Thesis	6(0-0-12-12)										6
79	MSE4989E	Research Thesis (For Integrated Bachelor-Master program)	8(0-0-16-16)										8

3. Bachelor Course Outlines

MSE1012 Introduction to Engineering

- Credits: 2(2-1-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Introduce general knowledge of materials science and engineering; relationship between materials and social development; basic concepts, classification and application of materials: metals, ceramics, polymers, electronic materials, biomedical ... Advanced and nanostructured materials. Materials fabrication and processing methods; technological processes and applied products.

MSE3206 Phase and Phase Relations

- Course Units: 3(3-1-0-6)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: This course provides the basis for the understanding of microstructure. It treats in quantitative terms and in some depth the concept of phases (crystalline and non-crystalline structures) and the relationships between phases (phase diagrams). Commercial practices for producing desired macroscopic phase configurations and macroscopic shapes are described (processing).

MSE3207 Materials Processing

- Course Units: 3(3-0-0-6)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Discussion of melt, mechanical, thermal, powder and surface processing of metals. Discussion of extraction of metals from their ores. The relationships between the processing of metals, the microstructures are produced and the behavior of metals components are emphasized.

MSE3407 Thermodynamics of Materials

- Credits: 3(3-0-0-6)
- Prerequisite:
- Pre-courses: None
- Corequisite Courses: None

Description: The subject provides in general of the thermodynamics such as three laws of thermodynamics and their applications to equilibrium and the properties of materials. Auxiliary

functions, phase rule, fundamental principle to construct phase diagram, chemical equilibrium changing ratio and equilibrium in multicomponent, reaction systems.

MSE 3416 Kinetic Processes in Materials

- Course Units: 3 (3-0-0-6)
- Prerequisite:
- Pre-courses: None
- Corequisite Courses: None

Description: Studies kinetics of chemical reactions; rate equations, reaction mechanisms; transport processes; diffusion equations, atomic and molecular diffusion. Phase transformations; nucleation, crystallization, displacive, spinodal decomposition. Examines surface and interface phenomena; sintering, grain growth, recovery and recrystallization.

MSE3417 Material Chemistry

- Credits: 2(2-0-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Basic theoretical and experimental areas of Solid-State Chemistry. Several basic and general principles about the atomic level growth of solid material (crystalline and amorphous), as well as surfaces. Basic structural chemistry, solid solution, microstructures and phase transformation. Structure and bonding of molecular coordination compounds. Important synthesis methods in solid state and of transition metal complexes, ligand substitutions. Examples and applications will be taken from, e.g., the energy area.

MSE3456 Analysis of Data

- Credits: 3(3-0-0-6)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Descriptive statistics including data summary and presentation; Random variables and probability distributions; Distributions of sampling statistics. Hypothesis testing and decision making for single and multiple samples; Regression/building empirical models; Analysis of Variance (ANOVA). Introduction to uncertainty and error analysis of experimental data causes and types of experimental errors. More about ANOVA: Multiple comparisons, residuals and model adequacy checking, checking model assumptions, the Box-Cox method. Choice of sample size in designed experiments. Factorial Designs: Introduction to factorial designs, 2k factorial designs, Residual analysis and model checking, blocking and confounding in two level factorial designs, case studies. Two-Level Fractional Factorial Designs: Introduction, The One-Half Fraction of the 2k design, case studies.

MSE3126 Mechanics for Materials

- Course Units: 3(3-0-0-6)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Topics from statics, mechanics of materials, and fluid mechanics pertinent to the fields of metallurgical engineering, ceramic engineering, and materials science and engineering: force resultants, stresses and strains produced in elastic bodies, microscopic effects of different loading states (tension, compression, torsion and bending) on deformable bodies, beam stresses and deflections, introduction to three-dimensional stresses and strains, stress and strain-rate relationships for Newtonian and non-Newtonian fluids, conservation equations (control volume analysis) for fluid flow, Reynolds number, and slow inertial and turbulent flows. This course is tailored for students with interests in materials science and engineering

MSE 3436 Microstructural Determination

- Course Units: 3(2-1-1-6)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Studies of the fundamentals and applications of various forms of microscopy (image formation) and diffraction for characterization of physical microstructure and of various forms of spectroscopy for characterization of chemical microstructure of materials.

MSE3427 Synthesis of Materials

- Course Units: 2(2-0-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Studies fundamentals of the synthesis of materials. Examines principles of synthesis; processes, approaches, synthetic methodology and probes; methodologies in materials synthesis; polymerization, sol-gel processes, liquid and vapor phase synthesis, materials coupling reactions, and precursor-derived, radiation-induced and asymmetric synthesis.

MSE3317 Materials Laboratory I

- Course Units: 2(0-0-4-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Students have to experiment by themselves with the instructions of lecturer and apply their knowledges to explain that.

MSE4175 Solidification Processing

- Course Units: 2(2-0-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Principles of control of structure, properties, and shape in processes involving liquid-solid transformations; stresses, heat flow, mass transport, solute redistribution, and nucleation and growth kinetics; relationship between process variables and structures and properties in the resultant material; examples are drawn from existing commercial and new developing processes.

MSE3446 Thermal-Mechanical Behavior of Materials

- Course Units: 3(2-1-1-6)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Studies fundamentals of elastic, viscoelastic and plastic deformation of materials, elementary theory of statics and dynamics of dislocations; examines strengthening mechanisms and behavior of composites; fracture and fatigue behavior; fundamentals of thermal behavior: heat capacity, thermal expansion and conductivity; effects of thermal stress

MSE3447 Electronic, optical and magnetic properties of Materials

- Credits: 3(2-2-0-6)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: This course offers a description of how the electronic, optical and magnetic properties of materials originate from their electronic and molecular structure and how these properties can be designed for particular applications, for instance in optical fibers, magnetic data storage, solar cells, transistors and other devices. It also offers experimental exploration of the electronic, optical and magnetic properties of materials, including hands-on experimentation using spectroscopy, resistivity, impedance and magnetometry measurements.

MSE4156 Corrosion of Metals

- Course Units: 3(3-0-0-6)

- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Electrochemistry, thermodynamics and kinetics of corrosion; behavior of ferrous and non-ferrous metals; corrosion rates; corrosion control; cathodic and anodic protection; high temperature corrosion; corrosion testing.

MSE3326 Materials Laboratory II

- Course Units: 2(0-0-4-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Students have to experiment by themselves with the instructions of lecturer and apply their knowledges to explain that.

MSE 4405 Materials Design

- Course Units: 2(2-0-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Design of various engineering devices, objects, or systems. Projects directed toward the development of materials-based solutions to problems originating from student, faculty, and industrial suggestions will be team-based and faculty guided. Solutions are to be based on the knowledge, skills, and design experience acquired in earlier course work and incorporate engineering standards and realistic constraints including most of such factors as economic, environmental, sustainability, manufacturability, ethical, health and safety, social, and political concerns.

MSE4407 Smart Materials

- Course Units: 2(2-0-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Introduction of smart materials based on alloys, polymers, ceramics and composites. Principles, mechanisms, synthesis and properties of shape-memory materials, piezoelectric materials, thermoelectric materials, materials with special thermal, electrical, optical and magnetic properties, smart gels, self-healing materials, MEMs,.. The effect of composition, heat treatment and other factors on structure and properties of smart materials. Applied in biomedical and engineering: dental, orthopedic, surgical, aerospace, automotive, robotic, sensors, energy, etc.

MSE4408 Nanostructured Materials

- Course Units: 2(2-0-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: This course introduces students to the field of nanostructured materials. Nanostructured materials have chemical and physical properties that are significantly different from those of bulk materials. The course will cover the structure and properties of a variety of nanoscale materials. In addition, it will cover the synthesis and assemble of nanoscale materials based on top-down and bottom-up approaches. The major potential applications of nanostructured materials will also be discussed.

MSE2024E Technical Writing and Presentation

- Credits: 2(1-2-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Learning outcomes identify the critical performances, and the knowledge, skills and attitudes that successful students will have reliably demonstrated through the learning experiences and evaluation in the course. To achieve the critical performance, students will have demonstrated the ability to:

1. Define report scope and content
2. Set writing objectives and define goals for proper messaging and delivery of information to a variety of audiences.
3. Develop project roles, responsibilities and relationships
4. Research, analyze, design, develop and deliver an effective written or oral presentation
5. Write in clear and concise manner (business/technical writing technique)
6. Define, write and review report content
7. Develop and communicate project specifications
8. Communicate and analyze research findings
9. Build a business case that address project needs
10. Present project concepts and ideas to user groups and stakeholders.

MSE4015 Metals Processing

- Course Units: 2(2-0-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Discussion of melt, mechanical, thermal, powder and surface processing of metals. Discussion of extraction of metals from their ores. The relationships between the

processing of metals, the microstructure is produced, and the behavior of metals components are emphasized.

MSE4117 Design of Engineering Alloys

- Course Units: 2(2-0-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Examines the application of science and engineering principles to the design, selection and performance of engineering alloys. Studies alloy classes, design, effect of alloying elements, relation to processing variables and structure-property relationships; design project.

MSE4118 Composite Materials

- Credits: 2(2-0-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Introduction to metal and ceramic matrix composites with an emphasis on understanding the interrelationships between processing, microstructure and properties. The basic for selecting these systems for different engineering applications are considered.

MSE4119 Clean Energy Materials

- Credits: 2(2-0-0-4)
- Prerequisite: MSE3025; MSE2023
- Pre-courses: None
- Corequisite Courses: None

Description: The course gives a briefing on the applications of materials in clean energy. Materials principles, limitations, and challenges of clean energy technologies, including solar, fuel cells, rechargeable Li-ion batteries, thermos-electrics, and energy storage will be studied. In addition, the course also evaluates correlations between the limitations and challenges based on key figures of merit and the basic structural, transport, and physical principles. Finally, fabricating devices technologies which exhibiting optimum operating efficiencies and extended life at reasonable cost are introduced.

MSE4651E Amorphous Materials

- Credits: 2(2-1-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: This course discusses the fundamental material science behind amorphous solids, or non-crystalline materials. Amorphous and non-crystalline structures are examined along with the kinetics necessary to produce such structures. The influence of these structures on the mechanical, electrical, dielectric, magnetic, thermal and optical properties of the materials is also examined. Characterization methods and technical applications are also discussed.

MSE4652 Functional Materials

- Credits: 2(2-0-0-4)
- Prerequisite:
- Pre-courses:
- Corequisite Courses: None

Description: The key to the development and improvement of functional materials with the feature properties is a detailed understanding of their physical and chemical working principles, their synthesis and preparation and their characterization. The course focuses on the design of material properties for model device technologies as well as emerging and potential engineering applications. The content shows the processing, analyzing of material structure and knowledge the way of fabrication of functional materials with designed properties such as: optical, electric, magnetic, thermal, biomimetic, energy or environmentally. After that, understanding materials research and development in academia and industry, with aptitude to grasp the economic and environmental effects of new materials.

MSE4653 Atomic Scale Simulation

- Credits: 2(2-0-0-4)
- Prerequisite:
- Pre-courses:
- Corequisite Courses: None

Description: This class covers computer simulations on atomistic length and time scales for (structural or thermodynamic) properties of materials, numerical algorithms, and systematic and statistical error estimations. Concepts of statistical mechanics such as phase space and averages are critically important for this class.

MSE4654 Solid State Electronic Devices

- Course Units: 2(2-0-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: To learn crystal structures of elements used for fabrication of semiconductor devices. To study energy band structure of semiconductor devices. To understand fermi levels, movement of charge carriers, Diffusion current and Drift current. To study behavior of semiconductor junction under different biasing conditions. Fabrication of different semiconductor devices, Varactor diode, Zener diode, Schottky diode, BJT, MOSFET, etc. To study the VI Characteristics of devices and their limitations in factors like current, power frequency. To learn photoelectric effect and fabrication of opto-electronic devices.

MSE3161E Materials for extreme conditions

- Credits: 2(2-0-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: The subject introduces the behavior of materials in harsh working environments such as high temperature and high pressure environments, intense corrosive environments, high electric and magnetic fields, environmental abrasive high pressure surface. Provides the knowledge of the interactions of the harsh working environment with the surface of the material, the variation of the microstructure and the properties required. Based on that, it provides the basic theories that enable students to access, select and use materials as well as apply the technology in a rational way.

MSE4655 Advanced Ceramics

- Credits: 2(2-0-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Ceramic materials definition, classification, characteristic, chemical components and structural; Mechanical, physical, thermal and electrical properties of ceramic materials; Principles of technology for manufacturing Ceramic materials; The technical ceramics applies in the industry: Ceramics and Refractories, Technical Ceramics for mechanical, electronic and biomedical application.

MSE4656 Surface and thin film technology

- Credits: 2(2-0-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Basic concepts and methods of surface treatment and thin film fabrication: mechanical, thermal, chemical, and physical surface treatments, thin film fabrication by PVD, CVD, epitaxial. Methods of structural evaluation and measurement of the basic properties of thin films: electrical properties, magnetic properties, mechanical properties. General introduction about main applications of thin films.

MSE4657 Nanobiomaterials Technology

- Credits: 2(2-0-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: This course will introduce knowledge of nanomaterials use in biology system. Knowledge of biology related to implant materials such as protein, cell, tissue, responses of host body to implant materials (immunity responses, inflammation and wound healing, hypersensitivity, blood-materials reaction) and some important techniques in biomaterials science field also provided.

MSE4658 Nanosensor and devices

- Course Units: 2(2-0-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: This course will introduce knowledge of the fundamental concepts of nanosensors and devices. To understand the working and circuitry of nanosensors and devices

MSE4659 Carbon Nanotechnology

- Course Units: 2(2-0-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: This course will introduce knowledge of the fundamental and application of carbon nanotechnology. To study the synthesis, properties, characterization, manipulation and application of carbon nanostructured materials and devices.

MSE 3151E Advanced Materials Processing

- Course Units: 2(2-0-0-4)
- Prerequisite: None
- Pre-courses: None
- Corequisite Courses: None

Description: Fundamentals of materials processing. Building engineering structures from the atomic-and nano-scales to macroscopic levels (bottom-up processing). Case studies illustrating application of processing science to creation of modern metallic, ceramic and polymeric components and devices

MSE4095E Engineering Practicum

Course Units: 2(0-0-4-4)

Description: This module aims to help students synthesize and apply gained knowledge and practice at internship enterprises according to management aspects, identify problems of enterprises/manufacturing/factory/industry, factors affecting business results and effectiveness, and create firm basic to carry out graduation thesis. After completing this module, students will be able to: know the key contents need to collect data and analyze in their internship fields at

enterprise; know how to plan and conduct the actual data collection on production and business as required by the subject; know how to assess the level of business performance and the functional aspects of business management based on evaluation criteria (sales and marketing, human resources, materials and fixed assets management, cost management, and financial performance); Identify key issues facing the business; determine the topic for graduation thesis.

MSE4999E Bachelor Thesis

Course Units: 6(0-0-12-12)

Description: The graduation thesis is a student's initial research on a practical or theoretical problem with the purpose of supplementing, completing, enriching the knowledge and skills that have been provided in the first step is to solve practical problems with the creativity of the students under the guidance of the instructor.

The aim of the course is to help students:

- Synthesize, systematize all the knowledge and skills that they use to solve a specific task in the field of industrial metallurgy, materials science and engineering in organizations/businesses and/or manufacturing/factories.
- Practice thinking, analytical skills, problem solving and problem-solving skills, writing and presentation skills.
- Training skills independently and promote capacity as well as creative ability.
- A basis for the university to allow the thesis defense, assessment, recognition and award of graduation degrees for students.

4. Quá trình cập nhật chương trình đào tạo (Program change log)

LẦN CẬP NHẬT: 01	
Số Quyết định/Tờ trình/Công văn:	
Ký ngày:	
Phòng Đào tạo nhận ngày:	
Áp dụng từ khóa:	
Áp dụng từ kỳ:	
Nội dung tóm tắt của đề xuất cập nhật (kèm ghi chú nếu có):	

LẦN CẬP NHẬT: 02	
Số Quyết định/Tờ trình/Công văn:	
Ký ngày:	
Phòng Đào tạo nhận ngày:	
Áp dụng từ khóa:	
Áp dụng từ kỳ:	

Nội dung tóm tắt của đề xuất cập nhật (kèm ghi chú nếu có):

LẦN CẬP NHẬT: 03

Số Quyết định/Tờ trình/Công văn:

Ký ngày:

Phòng Đào tạo nhận ngày:

Áp dụng từ khóa:

Áp dụng từ kỳ:

Nội dung tóm tắt của đề xuất cập nhật (kèm ghi chú nếu có):

LÀN CẬP NHẬT: 04

Số Quyết định/Tờ trình/Công văn:

Ký ngày:

Phòng Đào tạo nhận ngày:

Áp dụng từ khóa:

Áp dụng từ kỳ:

Nội dung tóm tắt của đề xuất cập nhật (kèm ghi chú nếu có):

LÀN CẬP NHẬT: 05	
Số Quyết định/Tờ trình/Công văn:	
Ký ngày:	
Phòng Đào tạo nhận ngày:	
Áp dụng từ khóa:	
Áp dụng từ kỳ:	
Nội dung tóm tắt của đề xuất cập nhật (kèm ghi chú nếu có):	

LÀN CẬP NHẬT: 06	
Số Quyết định/Tờ trình/Công văn:	
Ký ngày:	
Phòng Đào tạo nhận ngày:	
Áp dụng từ khóa:	
Áp dụng từ kỳ:	
Nội dung tóm tắt của đề xuất cập nhật (kèm ghi chú nếu có):	

LÀN CẬP NHẬT: 07	
Số Quyết định/Tờ trình/Công văn:	
Ký ngày:	
Phòng Đào tạo nhận ngày:	
Áp dụng từ khóa:	
Áp dụng từ kỳ:	
Nội dung tóm tắt của đề xuất cập nhật (kèm ghi chú nếu có):	

LÀN CẬP NHẬT: 08	
Số Quyết định/Tờ trình/Công văn:	
Ký ngày:	
Phòng Đào tạo nhận ngày:	
Áp dụng từ khóa:	
Áp dụng từ kỳ:	
Nội dung tóm tắt của đề xuất cập nhật (kèm ghi chú nếu có):	

LÀN CẬP NHẬT: 09	
Số Quyết định/Tờ trình/Công văn:	
Ký ngày:	
Phòng Đào tạo nhận ngày:	
Áp dụng từ khóa:	
Áp dụng từ kỳ:	
Nội dung tóm tắt của đề xuất cập nhật (kèm ghi chú nếu có):	

LÀN CẬP NHẬT: 10	
Số Quyết định/Tờ trình/Công văn:	
Ký ngày:	
Phòng Đào tạo nhận ngày:	
Áp dụng từ khóa:	
Áp dụng từ kỳ:	
Nội dung tóm tắt của đề xuất cập nhật (kèm ghi chú nếu có):	