



# **CURRICULUM FRAMEWORK**

*PROGRAM CODE: 7520201*

## **BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING**

**Electrical and Computer Engineering program**

**Applicable for the intake beginning in 2022 - 2023**

*(Decision 421a/2023/QĐ-VUNI, Dated: Dec 9th, 2023 by the Provost of VinUniversity)*

*This curriculum framework has been reviewed and validated by  
Cornell University*



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## 1. VINUNI GENERIC GRADUATE ATTRIBUTES

Generic graduate attributes are a set of skills, attributes, and values that all learners should achieve regardless of discipline or field of study; should be measurable and broad. The five Generic Graduate Attributes for VinUni, framed around the EXCEL Model, are listed as below:



## 2. PROGRAM EXPECTED OUTCOMES

### 2.1 Program Profile

Name of the degree	Bachelor of Science in Electrical engineering
Name of the program	Electrical and Computer Engineering (ECE)
Program duration	to be completed in 4 years on a full-time basis
Total credits	<b>Option 1 Single major:</b> 123 credits
	<b>Option 2 Major + minor in Robotics or Product Design or Artificial Intelligence or another minor:</b> 131 credits

### 2.2 Program Purpose

*The overall aim of the program is to nurture and develop young leaders in electrical engineering with clear direction and vision, creativity and sound personal values; who pave the way for the development of science and technology, to increase labor productivity and to benefit society.*

## **2.3 Program Educational Objectives and Student Outcomes**

### **2.3.1 Program Educational Objectives**

The educational objectives of the Bachelor of Science in Electrical Engineering program are that within a few years of graduation, a majority of our graduates will demonstrate excellence in top graduate programs; or in technical and managerial leadership tracks in technology-based industries or other sectors; or pursuing entrepreneurial ventures. In these roles they will:

1. Apply basic knowledge of electrical engineering principles and in-depth knowledge of one area of concentration to solve a full range of technical and societal problems;
2. Conceive, design, and realize products, systems, and services, while properly respecting economic, environmental, cultural, safety, and ethical standards or constraints;
3. Be leaders with an entrepreneurial mindset, effective communicators, and informed decision makers as members of multidisciplinary teams, supporting collaborative and inclusive environments;
4. Discover and apply new knowledge, and engage in life-long learning for the profession of electrical engineering;
5. Engage with their communities, profession, the nation, and the world.

### **2.3.2 Student Outcomes**

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics;
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;
3. An ability to communicate effectively with a range of audiences;
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts;
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives;
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions;

7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies;
8. An entrepreneurial mindset and a recognition of the importance of traditional values, national pride and global awareness.

### 3. CURRICULUM STRUCTURE

#### 3.1 Curriculum Composition

No.	Curriculum Components	Number of Credits (New)	Credit Distribution (%/Total Credits)
<b>I</b>	<b>GENERAL EDUCATION</b>	<b>27</b>	<b>22%</b>
I.1	<i>University Core Requirement</i>	12	9.8%
I.2	<i>Distributional Requirement</i>	12	9.8%
I.3	<i>Co-curricular Learning</i>	3	2.4%
<b>II</b>	<b>NATIONAL DEFENSE EDUCATION</b>		
<b>III</b>	<b>PROFESSIONAL EDUCATION</b>	<b>96</b>	<b>78%</b>
III.1	<i>College Core Requirement</i>	41	33.3%
III.2	<i>Major Core Requirement</i>	15	12.2%
III.3	<i>Major Foundation Requirement</i>	15	12.2%
III.4	<i>Area of Concentration (Elective)</i>	12	9.8%
III.5	<i>Free Electives (minor*)</i>	7 (15*)	5.6%
III.6	<i>Internship/Co-op (at least 640 hours)</i>	Non-credit	
III.7	<i>Capstone Design</i>	6	4.9%
	<b>TOTAL</b>	<b>123 (131*)</b>	<b>100%</b>

\* *Instead of taking 7 credits of free electives, students have an option of taking 15 credits to fulfill the requirements of a minor. Free electives can be any courses offered by CECS or the other colleges at VinUniversity.*

### 3.2 Courses and Credit Distribution by Courses

No	Course code	Name of Courses	Total Credit	Credit Allocation	
				Theory	Practice
<b>I</b>	<b>GENERAL EDUCATION (GenED)</b>		<b>27</b>		
<b>I.1</b>	<b>University Core Requirement</b>		<b>12</b>		
1	ENGL1011	Fundamental of Academic Writing <sup>[1]</sup>	3		
2	ENTR1021	Agile Innovation and Entrepreneurship <sup>[2]</sup>	3		
3	LEAD1030	Leadership and Teambuilding Boot Camp <sup>[3]</sup>	2		
4	THINK1010	Critical Thinking	2		
5	HASS1070	Cross Cultural Navigation	2		
6	VCOR1021/ 22	Healthy Lifestyle 1,2 <sup>[4]</sup>	Non-credit required (45 hours)		
<b>I.2</b>	<b>Distributional Requirement</b>		<b>12</b>		
1	HASS1010	Marxism-Leninism Political Economy (Philosophy, Science and Society) <sup>[5]</sup>	3		
2	HASS1020	Marxism-Leninism Philosophy (Global Political Economy) <sup>[6]</sup>	2		
3	HASS1030	Scientific Socialism (Politics and Social Change) <sup>[7]</sup>	2		
4	HASS1041/ 1042	Ho Chi Minh Ideology (Vietnam: History and Cultures II) <sup>[8]</sup>	2		
5	HASS1050	History of the Communist Party (Vietnam: History and Cultures I) <sup>[9]</sup>	2		
6	ARTS1010	Art Courses <sup>[10]</sup> (Students select one course in the pool, i.e. ARTS1010, MUSI1010)	1		
<b>I.3</b>	<b>Co-curricular Learning</b>				
1	VCOR1010A /B	OASIS (Orientation – Academic Skills – Identity and Service)	3		
<b>II</b>	<b>NATIONAL DEFENSE EDUCATION (as required by the Government for Vietnamese citizens)</b>		<b>165 hours</b>		
<b>III</b>	<b>PROFESSIONAL EDUCATION</b>				
<b>III.1</b>	<b>College Core Requirement</b>		<b>41</b>		

No	Course code	Name of Courses	Total Credit	Credit Allocation	
				Theory	Practice
1	MATH2010	Probability and Statistics	4	3	1
2	MATH1010	Calculus I	4	3	1
3	MATH1020	Calculus II	4	3	1
4	MATH2030	Differential Equations	3	2	1
5	MATH2050	Linear Algebra	4	3	1
6	PHYS1010	Physics I	4	3	1
7	PHYS2020	Physics II	3	2	1
8	PHYS2030	Physics III	2	2	0
9	CHEM2010	Chemistry	3	2	1
10	CECS1010	Introduction to Engineering and Computer Science	4	2	2
11	COMP1010	Introduction to Programming	4	2	2
12	LAW3010	Introduction to Law	2	2	
<b>III.2</b>	<b>Major Core requirement</b>		<b>15</b>		
1	ELEC2010	Introduction to Circuits for Electrical Engineers	4	3	1
2	ELEC2020	Signals and Information	4	3	1
3	ELEC3010	Digital Logic and Computer Organization	4	3	1
4	ELEC2030	Computer Systems Programming	3	3	0
<b>III.3</b>	<b>Major Foundation requirement</b>		<b>15</b>		
1	ELEC3020	Electromagnetic Fields and Waves	4	3	1
2	ELEC4010	Introduction to Microelectronics	4	3	1
3	ELEC4020	Embedded Systems	4	3	1
4	ELEC3030	Intelligent Physical Systems (Interdisciplinary Engineering Design Project)	3	2	1 (lab + project)
<b>III.4</b>	<b>Area of Concentration (Elective) (Select one)</b>				
III.4.1	<b>Communications and Signal Processing</b>		<b>12</b>		
1	ELEC3040	Digital Signal and Image Processing	4	3	1 (project)
2	ELEC4030	Computer Networks and Telecommunications	4	3	1
3	ELEC4040	Digital Communication System Design	4	3	1
III.4.2	<b>Control and Automation</b>		<b>12</b>		
1	ELEC3050	Control Systems	4	3	1
2	ELEC4050	Control System Theory and Design	4	3	1
3	ELEC4060	Robotics and Automation	4	3	1

No	Course code	Name of Courses	Total Credit	Credit Allocation	
				Theory	Practice
III.4.3	<b><i>Power and Clean Energy</i></b>		<b>12</b>		
1	ELEC3060	Introduction to Electric Power Systems	3	2	1
2	ELEC3070	Green Electric Energy	3	2	1
3	ELEC4070	Power Electronics	3	2	1
4	ELEC4080	Modern Distribution Systems with Renewable Resources	3	3	0
<b>III.5</b>	<b>Free Electives (or minor)</b>		<b>9 (15)</b>		
<b>III.6</b>	<b>Internship</b>				
1	ELEC3870	Internship	<i>640 hrs</i>		
<b>III.7</b>	<b>Capstone Design</b>		<b>6</b>		
1	ELEC4890	Capstone Design	6		6

**Note:** The GenED Curriculum adheres to Decision No.198/QD-VUNI dated May 6, 2022 by the Faculty of Arts and Sciences. Highlights:

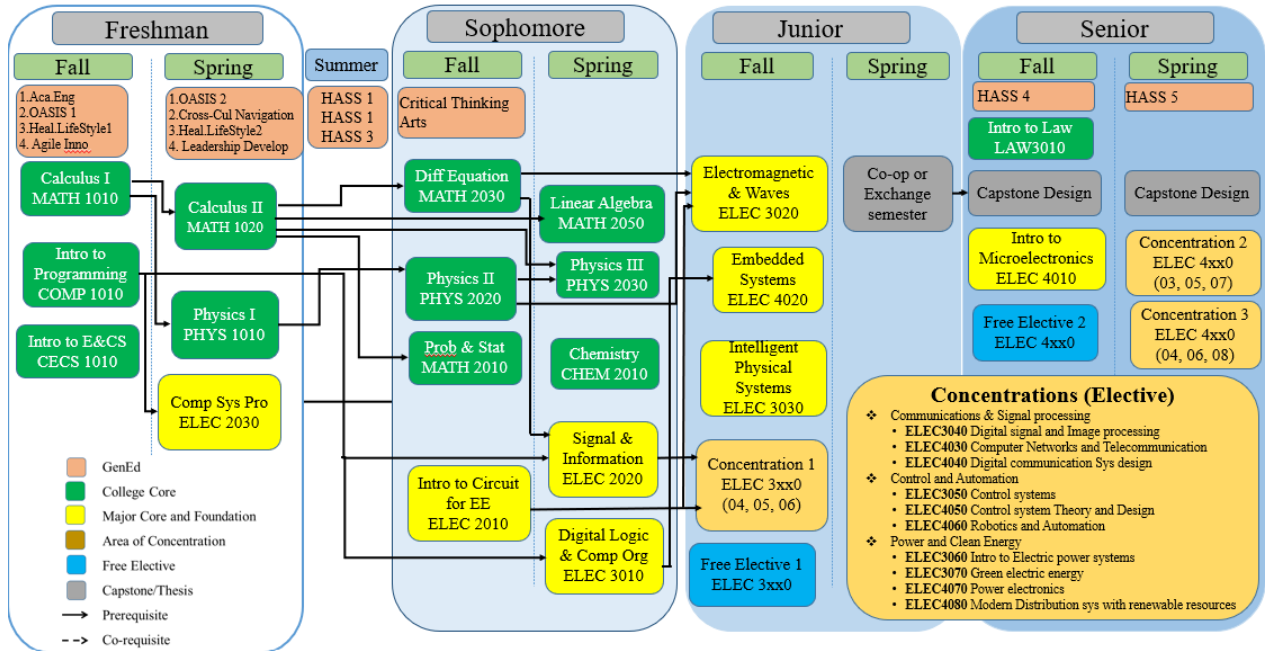
- <sup>[1]</sup> Academic English 1 (ENGL1010) and Academic English 2 (ENGL1020) applied to Cohorts 2020 and 2021. Since Academic Year 2022-2023, only one Academic English (3 credits) is compulsory for students, the other is optional. The name and code of the course is tentative and subject to change.
- <sup>[2]</sup> Agile Innovation & Entrepreneurship will merge into a single course with 3 credits from Academic Year 2022-2023.
- <sup>[3]</sup> LEAD1010-Leadership development applied to Cohorts 2021. LEAD1020-Organizational Behaviour applied to Cohorts 2020. Since Academic Year 2022-2023, the LEAD1010, LEAD1020 and Leadership Bootcamp will be integrated into LEAD1030-Leadership development and Bootcamp (2 credits).
- <sup>[4]</sup> To fulfill MOET's requirement of Physical Education and university core requirement. MOET requirement for physical education is a 45 hour course (equivalent to 3 credits) but not counted in total credits.
- <sup>[5, 6, 7, 8, 9]</sup> to fulfill Vietnam Ministry of Education and Training (MOET)'s requirements on politic and ideology education for undergraduate students.
- <sup>[10]</sup> Arts courses: Students can select either ARTS1010 or MUSI1010 to fulfill the art component requirement.
- Courses that have been removed from GenED curriculum: Introduction to Law, Computational and Algorithmic Thinking, Global Experiences. Introduction to Law is required by MOET and it will be run by each college from AY 2022-2023 to integrate with college's needs. Computational and Algorithmic Thinking is out of GenED curriculum and under CECS implementation. For Global Experience, individual colleges will decide the implementation format.
- National Defense Education is required by the government for all Vietnamese nation students and under FAS implementation.
- New courses added to GenED curriculum: Cross Cultural Navigation (2 credits) and Critical thinking courses. Critical thinking courses supplements for critical and creative framework. Students can choose one course in the critical thinking course pool. Cross-Cultural Navigation supplements for leadership framework, global awareness which play as university core requirements.



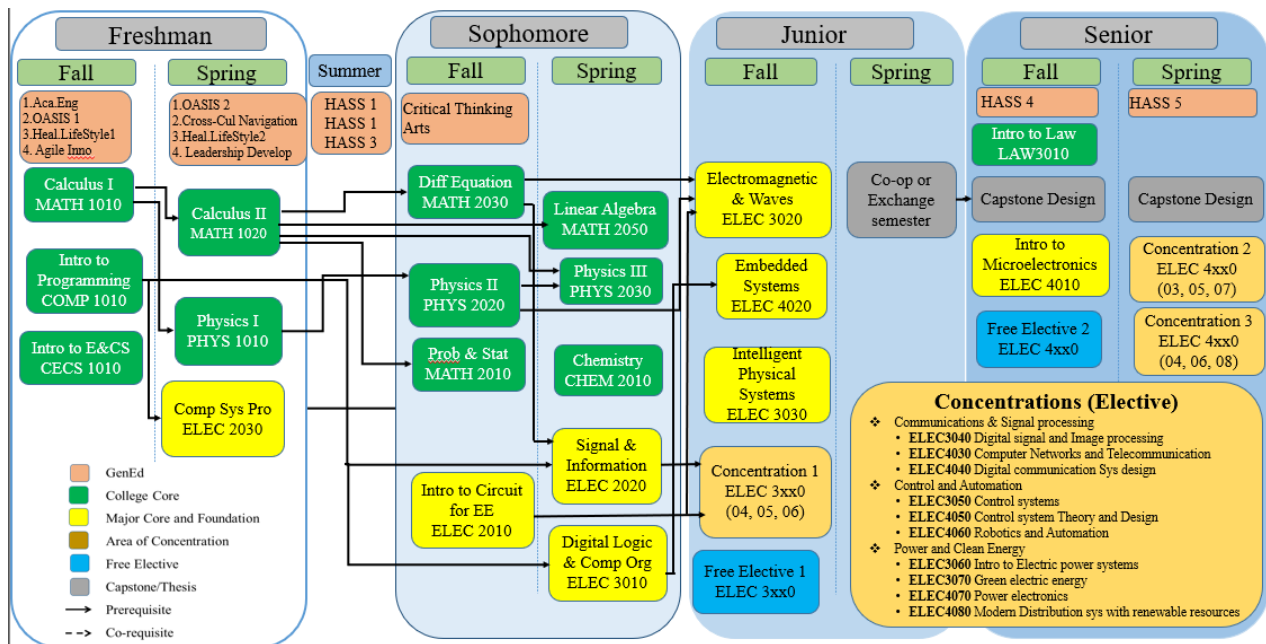
### 3.3 Curriculum Planner

There are two tracks: Main track and Pathway English track (for students who need to improve English requirement)

Course flow - Main track



Course flow – Pathway track



Main track:

Undergraduate Electrical Engineering Curriculum		GenED Core	College Core	Major core and Foundation	Area of Concentration	Free Electives/ Minor	Practice/ Internship	Graduation Thesis/ Capstone
Year 1 Fall	Calculus I		4					
	Introduction to Programming		4					
	Introduction to Engineering and CS		4					
	Agile Innovation & Entrepreneurship	3						
	Academic English	3						
	OASIS -Part 1	1						
	Healthy Lifestyle 1	Non-Credit						
<b>Total Semester Credits</b>		<b>19</b>						
Year 1 Spring	Calculus II		4					
	Physics I		4					
	Computer Systems Programming			3				
	OASIS- Part 2	2						
	Cross-cultural Navigation	2						
	Leadership Development	2						
	Healthy Lifestyle 2	Non-Credit						
<b>Total Semester Credits</b>		<b>17</b>						
Summer 1	HASS course 1	3						
	HASS course 2	2						
	HASS course 3	2						
<b>Total Semester Credits</b>		<b>7</b>						
Year 2 Fall	Differential Equations		3					
	Physics II		3					
	Probability and Statistics		4					
	Critical Thinking	2						
	Arts	1						
	Introduction to Circuits for Electrical Engineers			4				
<b>Total Semester Credits</b>		<b>17</b>						
Year 2 Spring	Linear Algebra		4					
	Physics III		2					
	Chemistry		3					
	Signals and Information			4				
	Digital Logic and Computer Organization			4				
<b>Total Semester Credits</b>		<b>17</b>						
Summer 2	Internship or exchange program						Non Credit	
Year 3 Fall	Embedded Systems			4				
	Electromagnetic Fields and Waves			4				
	Intelligent Physical Systems (interdisciplinary Design project)			3				
	Concentration 1				4			
	Free Elective 1					3		
<b>Total Semester Credits</b>		<b>18</b>						
Year 3 Spring	Co-op semester (No credit)							
<b>Total Semester Credits</b>		<b>0</b>						
Summer 3	Internship or exchange						No credit	
Year 4 Fall	Capstone Design							3
	Introduction to Microelectronics			4				
	HASS course 4	2						
	Introduction to Law		2					
	Free Elective 2						4	
<b>Total Semester Credits</b>		<b>15</b>						
Year 4 Spring	Capstone Design							3
	HASS course 5	2						
	Concentration 2				4			
	Concentration 3				4			
<b>Total Semester Credits</b>		<b>13</b>						

**Total Program Credit Hours 123**

Credit Hour Distribution	27	41	27	12	7	0	6
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Pathway track:

Undergraduate Electrical Engineering Curriculum		GenED Core	College Core	Major core and Foundation	Area of Concentration	Free Electives/ Minor	Practice/ Internship	Graduation Thesis/ Capstone
Year 1 Fall	Calculus I		4					
	Introduction to Programming		4					
	Introduction to Engineering and CS		4					
	Pathway English Advanced A	6						
	OASIS -Part 1	1						
	Healthy Lifestyle 1	Non-Credit						
<b>Total Semester Credits</b>		<b>19</b>						
Year 1 Spring	Calculus II		4					
	Physics I		4					
	Computer Systems Programming			3				
	OASIS- Part 2	2						
	Pathway English Advanced B	6						
	Healthy Lifestyle 2	Non-Credit						
<b>Total Semester Credits</b>		<b>19</b>						
Summer 1	HASS course 1	3						
	HASS course 2	2						
	Academic English	3						
<b>Total Semester Credits</b>		<b>8</b>						
Year 2 Fall	Differential Equations		3					
	Physics II		3					
	Probability and Statistics		4					
	Agile Innovation & Entrepreneurship	3						
	HASS course 3	2						
	Introduction to Circuits for Electrical Engineers			4				
<b>Total Semester Credits</b>		<b>19</b>						
Year 2 Spring	Linear Algebra		4					
	Physics III		2					
	Chemistry		3					
	Leadership Development	2						
	Signals and Information			4				
	Digital Logic and Computer Organization			4				
<b>Total Semester Credits</b>		<b>19</b>						
Summer 2	Internship or exchange program						Non Credit	
Year 3 Fall	Embedded Systems			4				
	Electromagnetic Fields and Waves			4				
	Intelligent Physical Systems (interdisciplinary Design project)			3				
	Art	1						
	Concentration 1				4			
	Free Elective 1					3		
<b>Total Semester Credits</b>		<b>19</b>						
Year 3 Spring	Co-op semester (No credit)							
<b>Total Semester Credits</b>		<b>0</b>						
Summer 3	Internship or exchange						No credit	
Year 4 Fall	Capstone Design							3
	Introduction to Microelectronics			4				
	HASS course 4	2						
	Critical Thinking	2						
	Introduction to Law		2					
	Free Elective 2					4		
<b>Total Semester Credits</b>		<b>17</b>						
Year 4 Spring	Capstone Design							3
	Cross-cultural Navigation	2						
	HASS course 5	2						
	Concentration 2				4			
	Concentration 3				4			
<b>Total Semester Credits</b>		<b>15</b>						
<b>Total Program Credit Hours</b>		<b>135</b>						
<b>Credit Hour Distribution</b>		<b>39</b>	<b>41</b>	<b>27</b>	<b>12</b>	<b>7</b>	<b>0</b>	<b>6</b>

### **3.4 Course Descriptions**

#### **ENGL1011: Fundamentals of Academic Writing**

**3 credits**

*Pre-requisites:* None

Fundamentals of Academic Writing is aimed at refining students' formal academic writing skills through a practical and active approach. The course focuses on much more than simply writing, though, and students will strengthen their core academic literacies and formal communication skills to thrive in other VinUniversity courses and equip themselves with strategies for long-term success in academic and professional communication.

The course begins by focusing on academic writing at the essay level, helping students understand the aspects which make academic writing different from other styles of writing. Students will develop confidence in critically evaluating information and responding with sound argumentation and logical development of ideas. In this early stage of the course, students will strengthen core academic literacies including critical reading, summarizing, paraphrasing, and peer feedback. As the course progresses, the focus shifts towards incorporating secondary research into writing, developing students' abilities to evaluate credible sources and synthesize information with their original ideas to have a voice in the broader academic community and develop authority in communicating ideas to a wider audience. Students will develop essential academic literacies such as searching skills, strategies for reading journal articles, synthesizing information, citing and referencing, reference management, and other secondary research techniques. Finally, students will summarize key information they have found in the form of an academic poster, which is a common medium for visually communicating information in academic contexts.

Fundamentals of Academic Writing places active learning at the core, and every lesson includes practical activities to help students apply these skills. This course follows a process writing approach, which includes drafting, peer and teacher feedback, reflection, and revision before producing the final piece of writing. Working together in interdisciplinary groups, students will present, critique, and revise their work with their peers to build autonomy, write for an audience, and gain confidence as writers.

#### **ENTR1021: Agile Innovation & Entrepreneurship**

**3 credits**

*Pre-requisites:* None

The purpose of this course is to provide students with a basic understanding of the entrepreneurial and innovation mindset and provide students the opportunity to

learn about and develop skills and behaviors correlated with impactful entrepreneurs and innovators. Skills to be developed – through lecturing and in-class discussions, plus coaching on assignments and in-class exercises – include observation of real-world facts, identifying status-quos or problems, identifying core causes leading to status-quos, and to discover original ways to remove causes or to solve problems; networking with people to identify technological contributions, optimizing creativity, seeking feedback, and prototyping or mockup design. The pedagogical outcomes of this course include (i) development of creativity & out-of-the-box thinking, (ii) critical thinking through observation and abstractions, (iii) entrepreneurial mindset and (iv) teamwork on a social or environmental issue. As part of the course all students will engage in a 2-day hackathon to present and discuss optimization of team's solution to a real-world social or environmental problem. The course is intended for a mix of students from various academic disciplines, such as medicine, nursing, engineering, business, real estate, and hospitality.

### **LEAD1030: Leadership and Teambuilding Booth Camp**

**2 credits**

***Pre-requisites:*** None

This course is designed as a required course for freshmen to help the students' leadership development by introducing the basic concepts of leadership and organizational behavior. This course has one big goal for you: to practice and apply concepts and techniques learned in the class and your life to various scenarios. This course is also intended to provide an overview of leadership trends rather than to emphasize every detail and in-depth review of academic studies. Understanding a landscape of leadership will be possible under the structure of four modules: (1) Leader as a decision-maker, (2) Leader as a problem solver, (3) Leader as a designer, and (4) Leader as a game-changer. A leader in this turbulent world is expected to be a final decision-maker to find a creative solution for difficult challenges and will need to organize a group of people with a formal and informal system. Leadership Development offers a safe place for your learning of leadership. Practice, try, fail, and try again! This is the philosophy of this course.

The Boot Camp instills foundational leadership values and skills into students, while bringing the class together, building lasting cohesion, and creating esprit de corps. Students will learn and apply basic leadership concepts and skills through hands-on and experiential learning. Organized into individual and team-based events, the students will have to work individually and together to solve complex and dynamic problems taken from the military, government, and business sectors. This includes but is not limited to conducting long distance land navigation, negotiating physical obstacle courses, analyzing leadership case studies, and much

more. From developing self-awareness and thinking critically to innovating ideas and displaying resilience, students will learn critical elements of Self, Interpersonal, and Team Leadership. Following this course, students will gain a foundational understanding of key elements of leadership and better understand their strengths and how to effectively work in teams and organizations.

## **THINK1010 - Critical and Creative Thinking**

**2 credits**

*Pre-requisites:* None

Developing your own ideas in a logical and critical manner is an essential part of being a student in higher education. In this course you will learn about the nature of argumentation, how to evaluate arguments, uncover hidden premises, and sharpen your own thinking skills. We will start by looking at the difference between arguments and non-arguments and why being able to present an argument is such an important skill. Then we will look at different kinds of arguments, such as deduction, induction, and arguments from inference to the best explanation. Not all arguments are made equal. Some arguments are irrefutable - others barely convincing - and others still completely misleading. We will look at how you can assess the quality of an argument and avoid common logical pitfalls. Finally, we will finish by looking at some philosophical puzzles and paradoxes involving logic and reasoning including Hume's notorious problem of induction and the Sorites paradox.

## **HASS1070: Cross-Cultural Navigation**

**2 credits**

*Pre-requisites:* None

This course aims to equip students an understanding of one aspect of the so-called “global experience” and/or inter-cultural sensitivity, so that students can become knowledgeable about the ways in which individual identities, values, and perceptions and biases are shaped by cultures across the continentals through acquiring knowledge of theories practice related to the impact of culture in our daily ecologies in local and global contexts. In the end, students are able to identify and understand the inter-sectional of one’s own and others’ cultural identities in order to reflect on how various cultural concepts apply to your own life, communication and various areas of study.

## **VCOR1021/22: Healthy Lifestyle 1, 2**

Non-credit, required min 45 hours across Year

***Pre-requisites:*** None

“Healthy Lifestyle” is a mandatory and non-credit bearing course of the General Education Program. Undergraduate students are required to enroll in this course to fulfill part of the graduation requirements and are expected to complete it by the end of their first-year study. This course provides the essential knowledge, skills and practicum lessons (exercise/sport classes), whereby students are able to develop a suitable approach in attaining a physically, mentally, socially and spiritually healthy lifestyle.

Specifically, this course provides students with the knowledge to make better choices during their daily routines to build a healthy lifestyle. A healthy lifestyle includes physical wellbeing, psychosocial, and spiritual health. Students receive mentorship that guides and shapes their perspective, showcasing the importance of having a well-balanced life. Components of a healthy lifestyle will be discussed as a process and science that allows students to have a greater understanding of what it takes to achieve their goals for overall wellbeing. Nutrition and diet will be taught to dispel the myths about how and what you should eat to achieve desired health results. Having a healthy mind, healthy body, clarity of thought and the ability to effectively process information are key trademarks of a healthy lifestyle.

This course emphasizes practical application of the learned concepts in order to integrate subject matter into students’ current daily routines and throughout life. The majority of coursework will be held in different environments and venues in order to expose students to the many varieties of fitness tools and resources to maintain a healthy foundation.

## **HASS1010: Marxism-Leninism Philosophy (Philosophy Science and Society)**

**3 credits**

***Pre-requisites:*** None

Philosophy Science and Society is one of four courses in the General Education Program forming the ideology/national education component required for higher education curriculum as directed by the Ministry of Education & Training, Socialist Republic of Vietnam. These four courses are written to achieve the primary objective of helping students understand core values of both country and university through objective and critical academic lenses in a global context. As these courses will be taught in English to students for whom English is mainly a second language at VinUniversity, each course is designed to be delivered in the spirit of content-based language learning approach to help students both develop

English language competency (focusing on speaking, listening and reading) and basic understanding of the content.

Philosophy, Science & Society (PSS) provides students with a broad survey of key ideas in Philosophy, its relevance to society and the way we think we understand the world, or to put it broadly, “science.” We begin the course with an overview of the role of Philosophy and Metaphysics as we embark on this journey of critically re-examining the way we look at our world. In the second part of the course, we take a deep dive into questions of Epistemology, based on which students can orient and develop their creative thinking, philosophy of humanity and action. We follow up with an exploration of trends that came into being with the “social turn” of epistemology found in the critical works of Thomas Kuhn and later in the burgeoning body of works clustered as Sociology of Science. Following this radical re-thinking, we return to the fundamental questions about humanity posed in Social Philosophy and Ethics, to round up our critical inquiry of the complex relationship among philosophy, science and society.

## **HASS1020: Marxism-Leninism Political Economy (Global Political Economy)**

### **2 credits**

***Pre-requisites:*** None

Global Political Economy: Vietnam-Region-The World is one of four courses in the General Education Program forming the ideology/national education component required for higher education curriculum as directed by the Ministry of Education & Training, Socialist Republic of Vietnam. These four courses are written to achieve the primary objective of helping students understand core values of both country and university through objective and critical academic lenses in a global context. This course is designed to help students develop a critical lens to understand social reality and social issues, including pressing questions, such as: What is Vietnam’s place in the world? What are the opportunities and challenges for Vietnam in the current configuration of the global political economy? To do so, we begin with a brief introduction to the study of political economy, informed by different persuasions in Marx-Leninism, political science, economic, sociology, anthropology and history. Students will gain a nuanced understanding of this interdisciplinary field through hands-on workshops and exercises on the principles of scientific and logical arguments. The second part of this course will focus on specific issues related to globalization and international integration. In particular, we focus on the role of development, modernization, and regional development in Vietnam’s prospects in the world. Our case studies pay special attention to the immediate regions surrounding Vietnam, namely ASEAN, East Asia (in particular, China) and South Asia. In the third and final part of this course, we



examine the expressions of global inequality and consider how individuals and communities within Vietnam can move forward in an ever-globalizing world.

## **HASS1030: Scientific Socialism (Politics and Social Change)**

### **2 credits**

***Pre-requisites:*** None

Assuming a basic, strong, and even pivotal relationship between society and politics, the course Politics and Social Change will guide participants to a deep understanding of that relationship in Vietnam and the wider Asian region in the 20th and 21st centuries. The course explores key concepts of politics and social change, and in explication of those concepts, examine the dynamics of politics and social change in concrete terms.

*What can be learned?*

Students at the end of course will become familiar with the concepts of politics and social change of Vietnam. Students will also understand and compare Vietnam with national development efforts elsewhere in Asia. Finally, they will become familiar with major political and international relations developments from the 20th century.

The medium of instruction helps students to both develop English language competency (focusing on speaking, and articulation, reading) and discourse skills through continuous practice with classmates and instructor.

*Broad outlines*

The course begins with a basic appreciation of the concepts of politics and social change, moving into Marxism-Leninism and its application to understanding politics & social change, and extending into how Ho Chi Minh Thought applies Marxism-Leninism and also stands apart as a set of national and contextual ideas and practices. The processes of politics and social change of other countries in the Asia-Pacific are then explored for comparison and contrast.

*Medium of learning*

The guiding principle for learning at the Vin Uni is active learning. This approach engages students to be active in the learning process with methods that are more than, not without, the traditional base of lectures and tutorials. The instructor or teacher plays the role of facilitator and provides the environment where students responsibly and actively acquire as much as possible, rather than are passively given, the learning points that the course desires.

Participants in this course will learn and share through a mix of lectures, tutorials, non-judgmental journal writing, presentations, and learning to collaborate with

others through group projects. The learning environment should be safe, frank, friendly, collaborative, and enlightening.

The weekly lists of readings are divided into two types. Basic readings are recommended, and students should at least complete one for each week. Students who wish to do more can pick up the other basic and optional/additional readings.

### **HASS1041/1042: Ho Chi Minh Ideology (Vietnam: History and Culture II)**

**2 credits**

*Pre-requisites:* None

Vietnam History and Culture since 1858 is continuation of the first period (from ancient time to 1858) and covers the period from 1858 until today.

The main objective of the course is to analyze the development of Vietnam and its people from 1858 when France attacked and colonized VN through two Indochina wars (1946-1965) and (1954-1975) until today as Vietnam reunified and reformed and integrated into international system.

Due to its strategic geopolitical position, Vietnam has long been a global crossroads. So, this course tries to show as much as possible the parallels, interactions between Vietnam history and events and that happened in the world's stage.

The course also aims to reflect Vietnam history and culture through the central figure of Ho Chi Minh (1890-1969), the most famous Vietnamese during this period. His life and career reflected the development of the very period of Vietnam history.

Students are encouraged to do research himself to have broader view, discover new historical details.

### **HASS1050: History of the Communist Party (Vietnam: History and Culture I)**

**2 credits**

*Pre-requisites:* None

The great American humorist and writer Mark Twain once said, "History doesn't repeat itself, but it often rhymes." This course takes as its point of departure the possibility of using those rhymes of the past to better help us navigate our present and future. What lessons can we draw? As future businesspeople, health care professionals, engineers, and computer scientists, these lessons have far more relevance than you may imagine.

Vietnam History and Culture (I) examines Vietnamese history and cultural production from its early origins to 1858 and the French Colonial project. The curriculum is divided into five units. We begin the curriculum by considering the study of both history and culture from theoretical perspectives and consider what these mean in the Vietnamese context. Just what are “History” and “culture”? What does it mean to be Vietnamese? In the second unit, we consider the ancient construction of Vietnamese history and cultural production. The third portion of the course examines the Lý and Trần dynasties as well as the Ming Occupation. Fourth, we explore the movement of Vietnamese people southward and the Tây Sơn Rebellion. And finally, fifth, we assess the unification of Vietnam under the Nguyễn and what is to come.

Too often Vietnamese are portrayed in history as vessels upon which events happen to them. This course treats the Vietnamese as agents of their history, grappling with big questions and great problems. We also explore the Vietnamese people’s historical willingness to learn from and integrate foreign ideas and instruments to further develop the Vietnamese culture. To this end, we will wrestle with questions such as: What are the forces that have shaped Vietnamese identity? What drives the worldview(s) of Vietnamese? How has it been transformed over time?

## **ARTS1010: Arts Appreciation**

**1 credit**

*Pre-requisites:* None

Art Appreciation is a one-credit elective course that provides a general introduction to the visual arts, media, techniques, and history. This course takes on interdisciplinary approaches to equip students with a broad knowledge of the historical, practical, philosophical, cultural, and social contexts of the arts in order to help students gain the ability to articulate their understanding and interpretation of the arts. This course introduces students to aspects of arts research and curation, as well as elements, media, and methods used in creative processes. The application of the arts, especially visual arts in daily life and in the field of business, technology, and medicine is explored in this course. This course also aims to develop students’ appreciation for Vietnam arts and visual art forms by providing them with opportunities to explore the diversity and richness of what Vietnam has to offer in terms of the arts.

This course offers students opportunities to learn about how art is created and how it evolves over time; it would cultivate and enrich students’ artistic senses, experience, and enjoyment of different forms of arts even if the student is not an artist or does not have an ability to draw/paint. In addition, this course fosters and

supports students' development of oral and written presentation and communication, critical and analytical thinking, and multicultural perspectives.

This course does not require students to have any prerequisite experience in art theory or practice. Rather, it is a beginning-level course to help students familiarize themselves with the different types of arts, as well as learn how to observe, appreciate, speak, write intellectually about art. Furthermore, the course helps students to think about how art can be integrated and applied in their daily lives and their own fields of interest.

## **MUSI1010- Music Appreciation**

**1 credit**

***Pre-requisites:*** None

This course offers students opportunities to learn about how music is created and how it evolves over time; it would enrich students' musical sense, experience, and enjoyment of all types of music even if the student is not a musician. In addition, this course fosters and supports students' development of oral and written presentation and communication, critical and analytical thinking, and multicultural perspectives.

Specifically, students taking this course will have the opportunity to explore the history of music, from the primitive musical forms through contemporary pieces around the world. Forms and genres of music include classical, jazz, theatrical music, gospel, folk, soul, blues, Latin rhythms, country, rock & roll, and hip hop. Various arrays of Vietnamese music (traditional, contemporary, theatrical, V-pop) are also discussed in this course. The course explores the relationship between music and people's everyday life and social movements, and its cultural significance. Digital music and the evolution of the Internet and AI impacting music industry, music distribution, and global music access are also an important part of this course.

This course does not require students to have any prerequisite experience in musical theory or performance; i.e. students are not required to be able to sight-read sheet music, or play any musical instrument. Rather, it helps students become an active and intellectual music listener, as well as it helps students to think further on how music can be integrated and applied in the daily lives and their own fields of interest. This course is delivered in class and outside class environment if appropriate.

## **VCOR1010A/B: First Year Experience – OASIS**

**3 credits**

***Pre-requisites:*** None

OASIS – an acronym of Orientation, Advising, Skills, Identity & Diversify, Service Learning – is a mandatory, 90-hour with three-credit bearing course of the General Education Program.

It is offered through the students' residential colleges/dormitories, in collaboration with the General Education Program Committee. FYE is a foundational course aimed to equip the first-year students with a proper understanding of the general nature, value, and requirement of university education. It is designed to assist students to successfully navigate through their new experience of university learning. It also forms a solid basis of support from which students may further develop their personal and professional excellence in the university. The Service-Learning component, while being integrated into OASIS could create a unique experiential learning component that integrates students' academic study with the meaningful community service: Students will go outside the classrooms and serve the community by applying their professional knowledge to different stakeholders.

## **LAW3010 Introduction to Law**

**2 credits**

***Pre-requisites:*** None

Introduction to Law is designed to provide students with a foundational understanding of legal principles and their application within the context of engineering practice. First, the course introduces legal systems and sources of law including an overview of different legal systems, sources of law (e.g., statutes, regulations, case law), and the hierarchy of legal authority. Then, the course will explore the intersection of law and engineering fields, emphasizing the legal frameworks, regulations, and ethical considerations that engineers encounter throughout their careers. The topics covered but are not limited to contracts and agreements, intellectual property rights, health and safety regulations, environmental laws, standards compliance, professional codes of conduct, conflicts of interest, and ethical decision-making in engineering practice. The course is taught through a combination of lectures, case studies, discussions, and practical exercises.

## **MATH1010 Calculus I**

**4 credits**

**Pre-requisites:** High school three years high school mathematics, including trigonometry and logarithms, and at least one course in differential and integral calculus

This course teaches techniques of integration, finding areas and volumes by integration, exponential growth, partial fractions, infinite sequences and series, tests of convergence, and power series.

## **MATH1020 Calculus II**

**4 credits**

**Pre-requisites:** Calculus I

This course gives an introduction to multivariable calculus. Topics include partial derivatives, double and triple integrals, line and surface integrals, vector fields, Green's theorem, Stokes' theorem, and the divergence theorem.

## **MATH2030 Differential Equations**

**3 credits**

**Pre-requisites:** Calculus II

Taking with Linear Algebra simultaneously is not recommended.

This course gives an introduction to ordinary and partial differential equations. Topics include first order equations (separable, linear, homogeneous, exact); mathematical modeling (e.g., population growth, terminal velocity); qualitative methods (slope fields, phase plots, equilibria and stability); numerical methods; second order equations (method of undetermined coefficients, application to oscillations and resonance, boundary value problems and eigenvalues); and Fourier series. A substantial part of this course involves partial differential equations, such as the heat equation, the wave equation, and Laplace's equation.

## **MATH2050 Linear Algebra**

**4 credits**

**Pre-requisites:** Calculus II

Taking with Differential Equations simultaneously is not recommended.

This course teaches linear algebra and its applications. Topics include matrices, determinants, vector spaces, eigenvalues and eigenvectors, orthogonality and inner product spaces; applications include brief introductions to difference

equations, Markov chains, and systems of linear ordinary differential equations. This course also includes computer use in solving problems.

### **MATH2010 Probability and Statistics**

**4 credits**

*Pre-requisites:* Calculus II

This course gives students a working knowledge of basic probability and statistics and their application to engineering including computer analysis of data and simulation. Topics include random variables, probability distributions, expectation, estimation, testing, experimental design, quality control, and regression.

### **PHYS1010 Physics I**

**4 credits**

*Pre-requisites:* Calculus I (integration, finding areas and volumes by integration, exponential growth, partial fractions, infinite sequences and series, tests of convergence, and power series).

This course covers the mechanics of particles with focus on kinematics, dynamics, conservation laws, central force fields, periodic motion. Mechanics of many-particle systems: center of mass, rotational mechanics of a rigid body, rotational equilibrium, and fluid mechanics. Temperature, heat, the laws of thermodynamics.

### **PHYS2020 Physics II**

**3 credits**

*Pre-requisites:* Physics I

This course covers electrostatics, the behavior of matter in electric fields, DC circuits, magnetic fields, Faraday's law, AC circuits, and electromagnetic waves

### **PHYS2030 Physics III: Oscillations, Waves, and Quantum Physics**

**2 credits**

*Pre-requisites:* Physics II (Electromagnetism), Calculus II

This course covers the physics of oscillations and wave phenomena, including driven oscillations and resonance, mechanical waves, sound waves, electromagnetic waves, standing waves, Doppler effect, polarization, wave reflection and transmission, interference, diffraction, geometric optics and optical

instruments, wave properties of particles, particles in potential wells, light emission and absorption, and quantum tunneling.

### **CHEM2010 Chemistry**

**3 credits**

*Pre-requisites:* High school chemistry

This course covers basic chemical concepts, such as reactivity and bonding of molecules, introductory quantum mechanics, and intermolecular forces in liquids and solids and gases. Attention will be focused on aspects and applications of chemistry most pertinent to engineering.

### **CECS1010 Introduction to Engineering and Computer**

**Science**<https://classes.cornell.edu/browse/roster/FA18/class/CHEM/2090>

**4 credits**

*Pre-requisites:* None

This course provides a general introduction to the engineering design process—spanning core topics from problem definition through prototyping and testing, as well as other important considerations such as sustainability, failure analysis, and engineering economics. This course also emphasizes multidisciplinary design via a design project (e.g., design a line following robot) which involves students from different majors of college of engineering and computer science.

### **COMP1010 Introduction to Programming**

**4 credits**

*Pre-requisites:* None

This course teaches programming and problem-solving using Python. Emphasizes principles of software development, style, and testing. Topics include procedures and functions, iteration, recursion, arrays and vectors, strings, an operational model of procedure and function calls, algorithms, exceptions, object-oriented programming, and GUIs (graphical user interfaces).

### **ELEC2010 Introduction to Circuits for Electrical Engineers**

**4 credits**

*Co-requisites:* Differential Equations and Physics II

This course establishes the fundamental properties of circuits with application to modern electronics. Topics include circuit analysis methods, operational



amplifiers, basic filter circuits, and elementary transistor principles. The laboratory experiments are coupled closely with the lectures.

### **ELEC2020 Signals and Information**

#### **4 credits**

**Pre-requisites:** Differential Equations, Introduction to Programming, **Co-requisite:** Linear Algebra

This course teaches introduction to signal processing. Topics include frequency-based representations: Fourier analysis and synthesis; discrete-time linear systems: input/output relationships, filtering, spectral response; analog-to-digital and digital-to-analog conversion; continuous time signals and linear time-invariant systems: frequency response and continuous-time Fourier transform.

### **ELEC3010 Digital Logic and Computer Organization**

#### **4 credits**

**Pre-requisites:** Introduction to Programming

This course provides an introduction to the design and implementation of digital circuits and microprocessors. Topics include transistor network design, Boolean algebra, combinational circuits, sequential circuits, finite state machine design, processor pipelines, and memory hierarchy. Design methodology using both discrete components and hardware description languages is covered in the laboratory portion of the course.

### **ELEC2030 Computer Systems Programming**

#### **3 credits**

**Pre-requisites:** Introduction to Programming

This course provides a strong foundation in the principles, practices, and art of computer systems programming using the C and C++ programming languages. Students will learn procedural programming in C and how to theoretically analyze and practically implement basic data structures and algorithms. Students will transition to C++ to explore object-oriented, generic, functional, and concurrent programming before exploring advanced data structures and algorithms involving trees, tables, and graphs. Students will explore systems programming using the POSIX standard library. The course includes a series of programming assignments for students to put the principles they have learned into practice.

## **ELEC3020 Electromagnetic Fields and Waves**

### **4 credits**

**Pre-requisites:** Physics II, Differential equations, Introduction to Circuits for Electrical Engineers

This course covers static, quasi-static, and dynamic electromagnetic fields and waves. Topics include Maxwell's equations (integral and differential forms), fields of charge and current distributions, boundary conditions, fields near conductors, method of images, material polarization and dielectrics; energy, work, and power in electromagnetic systems; wave propagation and polarization, waves in media (dielectrics, conductors, and anisotropic materials); reflection, transmission, and refraction at media interfaces; guided waves in transmission lines, Smith charts, transients; metallic and dielectric waveguides; radiation and antennas, antenna arrays, electric circuits for transmission and reception, aperture antennas and diffraction.

## **ELEC4010 Introduction to Microelectronics**

### **4 credits**

**Pre-requisites:** Introduction to Circuits for Electrical Engineers

This course introduces the basic devices and circuits in modern microelectronics. Students learn not only basic structures and operations of semiconductor devices through simple models (diodes, CMOS, and BJT) but also how to analyze and design basic transistor modules in digital and analog circuits including biasing, amplifiers, filters, logic gates, and memory. The course introduces intuitive design methods to map circuit specifications to transistor topology, as well as first-order time-constant estimation. SPICE and measurement labs accompany the progress in lectures for hands-on experiences.

## **ELEC4020 Embedded Systems**

### **4 credits**

**Pre-requisites:** Digital Logic and Computer Organization

This course provides an introduction to the design of embedded systems, with an emphasis on understanding the interaction between hardware, software, and the physical world. Topics covered include assembly language programming, interrupts, I/O, concurrency management, scheduling, resource management, and real-time constraints.

## **ELEC3030 Intelligent Physical Systems**

**3 credits**

*Pre-requisites:* Introduction to Engineering, Programming language

This is an interdisciplinary design project course which involves students from different engineering and computer science programs. In this course, students will engage in a holistic design approach to Intelligent Physical Systems which can perceive, reason about, and act upon their environment. This course includes topics on algorithms, sensors, actuators, power, and mechanics. Students will learn the value and trade-offs between theory, simulation, and physical implementations, and gain familiarity with rapid prototyping techniques, system debugging, teamwork, leadership skills, time management, and how to disseminate work to a broader audience through wiki-pages.

## **ELEC3040 Digital Signal and Image Processing**

**4 credits**

*Pre-requisites:* Signals and Information

This course focuses on developing a toolbox of techniques to process and analyze real-world signals, model them under uncertainty/noise, and make decisions about them. Highlights of the course will include sampling, filtering, multirate signal processing, intro to statistical signal processing including Wiener and Kalman filtering, and the foundations of computer vision. The course will aim to include a broad range of applications including audio/music, imaging, and data analytics. The coursework includes a design project to emphasize design experiences.

## **ELEC4030 Computer Networks and Telecommunications**

**4 credits**

*Pre-requisites:* Embedded Systems

This course teaches basic networking with an emphasis on the Internet. Examples of topics include the World Wide Web, Email and Peer to Peer networks, data transmission and data encoding, circuit vs. packet switching, local area network technology, routing and switching, congestion control, network security, wireless networks, and multimedia. Though the emphasis will be on the Internet, application modules on 4G/5G cellular, WiFi (802.11), and Bluetooth will be presented.

## **ELEC4040 Digital Communication System Design**

**4 credits**

*Pre-requisites:* Probability and Statistics, Signals and Information

The course covers communication theory, transceiver algorithms that enable reliable communication, wireless channels, and modern communication standards (such as 3GPP LTE and WiFi). The students will design a working audio-band communication system that relies on orthogonal frequency-division multiplexing (OFDM).

## **ELEC3050 Control Systems**

**4 credits**

*Pre-requisites:* Introduction to Circuits for Electrical Engineers

This course covers the analysis and design of control systems with emphasis on modeling, state variable representation, computer solutions, modern design principles, and laboratory techniques. Topics include Modeling and dynamic response, Root locus design method, Frequency response design methods, State-space design.

## **ELEC4050 Control System Theory and Design**

**4 credits**

*Pre-requisites:* Control Systems

This course covers System modeling and analysis, System structural properties, Feedback system design, Optimum feedback control, Introduction to the minimum principle.

## **ELEC4060 Robotics and Automation**

**4 credits**

*Pre-requisites:* Control Systems

This course introduces fundamental concepts in robotics and applications. Topics include basics of manipulators, coordinate transformation and kinematics, trajectory planning, control techniques, sensors and devices, robot applications in industrial automation.

## **ELEC3060 Introduction to Electric Power Systems**

**3 credits**

***Pre-requisites:*** Signals and Systems

This course teaches modern electric power system modeling, analysis, and computation with a focus on analysis techniques appropriate for power system modeling, analysis, and power flow computation. Topics include transmission line models, transformers and per unit system, generator models, network matrices, power flow analysis and computation, real and reactive power control, voltage control, economic dispatch.

**ELEC3070 Green Electric Energy**

**3 credits**

***Pre-requisites:*** Introduction to Circuits for Electrical Engineers

This course provides a quantitative, practical introduction to a wide range of renewable energy systems. Topics include wind resource and turbines, Photovoltaic Cells, Solar Resource, Photovoltaic Systems, energy and financial performance of green energy projects; integration of green energy into the power grid, Demand Side Management, Economics of Energy Efficiency.

**ELEC4070 Power Electronics**

**3 credits**

***Pre-requisites:*** Introduction to Circuits for Electrical Engineers

This course teaches major power electronics concepts, from both systems and components perspectives and design considerations for switching power conversion. Topics include switching conversion and analysis, DC-DC converters, rectifiers and switched capacitor circuits, inverters, power semiconductors in converters, feedback control for converters, control modeling, and design, AC-AC conversion, resonance in converters.

**ELEC4080 Modern Distribution Systems with Renewable Resources**

**3 credits**

This ***Pre-requisites:*** Introduction to Electric Power Systems

course teaches the operation of modern electric power distribution systems with the integration of renewable energy sources. Topics include the operation of distribution systems, power quality, solar power systems, wind power systems, system efficiency, and cost-effectiveness.

## **MECE3870 Practice/Internship**

### **Non-credit course**

***Pre-requisites:*** Students must have completed sophomore year.

The professional structured internship offers students opportunities to apply theoretical knowledge to a real-world work environment and know more about companies that students may be interested in joining after graduation. During the internship, students will have the opportunity to discover and/or confirm their career interests, develop their major knowledge and gain valuable professional skills and connections with industry professionals. Students will complete the program under the guidance and support of a company advisor or Principal Investigator (PI), an industry mentor/ project researcher, and a faculty advisor, who will jointly help students to create SMART learning outcomes (specific, measurable, achievable, relevant and time-bound).

## **MECE4890 Graduation Thesis/Capstone**

### **6 credits**

***Pre-requisites:*** Practice/Internship; Determined by the advisor

This Capstone course is developed for students in the College of Engineering and Computer Science (CECS) to apply technical knowledge and skills acquired in earlier coursework to a project involving actual designs and experiments. Students are strongly encouraged to work on multidiscipline-major topics to produce an end-to-end solution to a complex real-world problem from industry or academia. The assessment methods are formulated from discussions and agreements between the industry and VinUni in accordance with ABET requirements. More specially, the project involves the development of engineering systems or design alternatives, along with testing the implemented systems. The project should focus on advanced technologies, new applications, and their usefulness and benefits in the development of economy and management. In this course, students work in teams of 3 to 5, with at least one student from the Mechanical Engineering (ME) Program and one from the Electrical Engineering (EE) Program, under the supervision of VinUni faculty instructors. Students are enrolled in Capstone I in the first semester to develop or tailor a project proposal and secure instructor approval. In the following semester, they must take Capstone II to complete the project. Students are expected to be present in person for every meeting of the classes in which they are enrolled. They should be able to deliver their work and contribution to the project and engage in professional dialogues about their project during formal presentations.