VINUNIVERSITY

CURRICULUM FRAMEWORK

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

PROGRAM CODE: 7520103

Applicable for Cohort 2024-2028, Academic Year 2024-2025

(Released along with Decision No. 479/2024/ QĐ-VUNI dated September 5, 2024, by Provost of VinUniversity)

This curriculum framework has been reviewed and validated by Cornell University

Records of changes

Version	Published date	Effective Date	Approved by	Description of changes
1	05/9/2020	05/9/2020	**Developed by**: Curriculum Review Taskforce **Reviewed by**: College Academic Committee; Scientific and Educational Committee **Approved by**: Provost	First release for Cohort 2024-2028

Contents

1. VINUNI 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 program degree	Bachelor of Science in Mechanical engineering
Program duration	to be completed in 4 years on a full-time basis
Total credits	***Option 1 Single major:*** 120 credits
	Option 2 Major + minor in Robotics or Product Design or Technopreneur or another minor: 135 credits

2.2 Program Purpose

The overall aim of the program is to nurture and develop young leaders in mechanical 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 Mechanical 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 mechanical 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 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;

3. CURRICULUM STRUCTURE

3.1 Curriculum Composition

No.	Curriculum Components	Number of Credits	Credit Distribution (%/Total Credits)
I	**GENERAL EDUCATION**	**31**	**24%**
I.1	*Enterprise and Innovation*	4	3.1%
I.2	*Leadership Mindset*	2	1.6%
I.3	*Civic Responsibility*	2	1.6%
I.4	*Ethics*	2	1.6%
I.5	*Community Service Learning*	45 hours	
I.6	*Working with the Brain*	2	1.6%
I.7	*Working with Technology*		1.6%
I.8	*Working with Others*	4	3.1%
I.9	*Working with the Self*	90 hours	
I.10	*Integrated Vietnam Studies*	11	8.5%
I.11	*Sustainability and Global Citizenship*	2	1.6%
I.12	*Creative Arts*	2	1.6%
III	**PROFESSIONAL EDUCATION**	**89**	**74.4%**
III.1	*College Core Requirement*	39	30.2%
III.2	*Major Core Requirement*	17	13.2%
III.3	*Major Foundation Requirement*	15	11.6%
III.4	*Area of Concentration (Elective)*	12	9.3%
III.5	*Minor**	15*	5.4%
III.6	*Co-op/Internship*	Non-credit (640 hours)	
III.7	*Capstone Design*	6	4.7%
	TOTAL	**120 (135)***	**100%**

***** *Students are required to complete a minimum of 120 earned credits to graduate. They have the option to take up to 135 earned credits within the allowed timeframe without incurring additional tuition fees.*

3.2 Courses and Credit Distribution by Courses

No	Code	Name of Courses	Total	Credit Allocation	
				Theory	Practice
I		**GENERAL EDUCATION (GenED)**	**31**		
I.1	**Enterprise and Innovation**		**4**		
1	ENTR1022	Agile Innovation and Entrepreneurship	2		
2	IDEA1010/ 11/12/X	Big Ideas: X *(The IDEA1010/11/12 series, titled 'Big Ideas (X)' will have its course code and title defined each semester, allowing the course content to align with the key themes and innovative design concepts)*	2		
I.2	**Leadership Mindset**		**2**		
	LEAD1031	Leadership and Teambuilding Bootcamp	2		
I.3	**Civic Responsibility**		**2**		
1	VCOR1030	National Defense Education	165 hrs		
2	LAW1010	Introduction to Law	2		
I.4	**Ethics**		**2**		
	TECH1010	Technology Ethics	2		
I.5	**Community Service Learning**				
	COSL1010	Community Service Learning	45 hrs		
I.6	**Working with the Brain**		**2**		
	THINK1010	Critical and Creative Thinking	2		
I.7	**Working with Technology** *(Student will take COMP1010 Introduction to Programming and MATH2010 Probability and Statistics in the College Core Requirement to fullfil this component)*				
I.8	**Working with Others** [1]		**4**		
1	ENGL1030	Academic and Professional Writing	2		
2	*Students select 1 in 2 below courses*				
2.1	ENGL1040	Interpersonal and Multimedia Communication	2		
2.2	MANA1011	Introduction to Managing Skills	2		
I.9	**Working with the Self**				
1	VCOR1012A /B	OASIS (Orientation, Advising, Skills, Identity & Diversity and Spirit of Pay-it-Forward)	45 hrs		

No	Code	Name of Courses	Total	Credit Allocation	
				Theory	Practice
2	VCOR1021/ 22	Healthy Lifestyle 1,2	45 hrs		
I.10	**Integrated Vietnam Studies**		***11***		
1	HASS1010	Marxism-Leninism Political Economy (Philosophy, Science and Society)	3		
2	HASS1020	Marxism-Leninism Philosophy (Global Political Economy)	2		
3	HASS1030	Scientific Socialism (Politics and Social Change)	2		
4	HASS1041/ 42	Ho Chi Minh Ideology (Vietnam: History and Cultures II)	2		
5	HASS1050	History of the Communist Party (Vietnam: History and Cultures I)	2		
I.11	**Sustainability and Global Citizenship** *(students may select 1 course from the list below)*		**2**		
1	HASS1070	Cross-Cultural Navigation	2		
2	HASS1100	Introduction to International Relations	2		
3	CECS1060	Humans and Environmental Intelligence	2		
4	UROP1010/ 20/30/40	UROP (Undergraduate Research Opportunity Program)	2		
I.12	**Creative Arts** [2] *(students may select 1 course from the list below)*		**2**		
1	ARTS1030	Arts Appreciation and Application	2		
2	PERF1010	Artistic Performance and Application	2		
II	**PROFESSIONAL EDUCATION**		***89***		
II.1	**College Core Requirement**		***39***		
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	PHYS2010	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

No	Code	Name of Courses	Total	Credit Allocation	
				Theory	Practice
10	CECS1010	Introduction to Engineering and Computer Science	4	2	2
11	COMP1010	Introduction to Programming	4	2	2
II.2	**Major Core requirement**		***17***		
1	MECE3010	Statics and Mechanics of Solids	4	3	1
2	MECE3020	Thermodynamics	3	3	0
3	MECE3030	Dynamics	3	3	0
4	MECE3040	Mechanical Synthesis	4	3	1
5	MECE3050	Introductory Fluid Mechanics	3	2	1
II.3	**Major Foundation requirement**		***15***		
1	MECE4010	Heat Transfer	3	3	0
2	MECE3060	Mechatronics	3	2	1
3	MECE4020	System Dynamics and Control	3	2	1
4	MECE3070	Mechanics of Engineering Materials	3	2	1
5	MECE3080	Intelligent Physical Systems (Interdisciplinary Engineering Design Project)	3	2	1 (lab + project)
II.4	**Area of Concentration (Elective)** *(Students may select one concentration below or design own concentration)*				
II.4.1	***Automotive Engineering***		***12***		
1	MECE3090	Automotive Engineering	3	2	1
2	MECE4030	Hybrid Electric Vehicles	3	2	1
3	MECE4040	Vehicle Dynamics and Control	3	2	1
4	MECE4050	Internal Combustion Engines	3	2	1
II.4.2	***Systems and Manufacturing***		***12***		
1	MECE3100	Introduction to Manufacturing Systems	3	2	1
2	MECE4060	Innovative Product Design via Digital Manufacturing	3	2	1
3	MECE4070	Additive Manufacturing	3	2	1
4	MECE4080	Feedback Control Systems	3	2	1
II.4.3	***Energy and Sustainability***		***12***		
1	MECE3110	Wind Power	3	3	
2	MECE4090	Sustainable Energy Systems	3	3	
3	MECE4100	Combustion Processes	3	3	

No	Code	Name of Courses	Total	Credit Allocation	
				Theory	Practice
4	MECE4110	Design of Sustainable Systems	3	3	
II.4.4	**Mechatronics**				
1	MECE4120	Sensors and Actuators	4	3	1
2	ELEC4020	Embedded Systems	4	3	1
3	ELEC4060	Robotics and Automation	4	3	1
II.5	**Minor** *(students may take minor in Robotics or Product Design or Artificial Intelligence or another minor offered by other colleges)*		***15***		
II.6	**Co-op/Internship**		0		
1	MECE3870	Internship	640 hrs		
2		Field trips to companies *(student must participate in at least 3 trips)*	*Non-credit*		
II.7	**Capstone Design**		6		
1	MECE4890	Capstone Design	6		6

Note:

For academic year 2024-2025 only, the following are also permitted as options for fulfilling some blocks in VinCore:

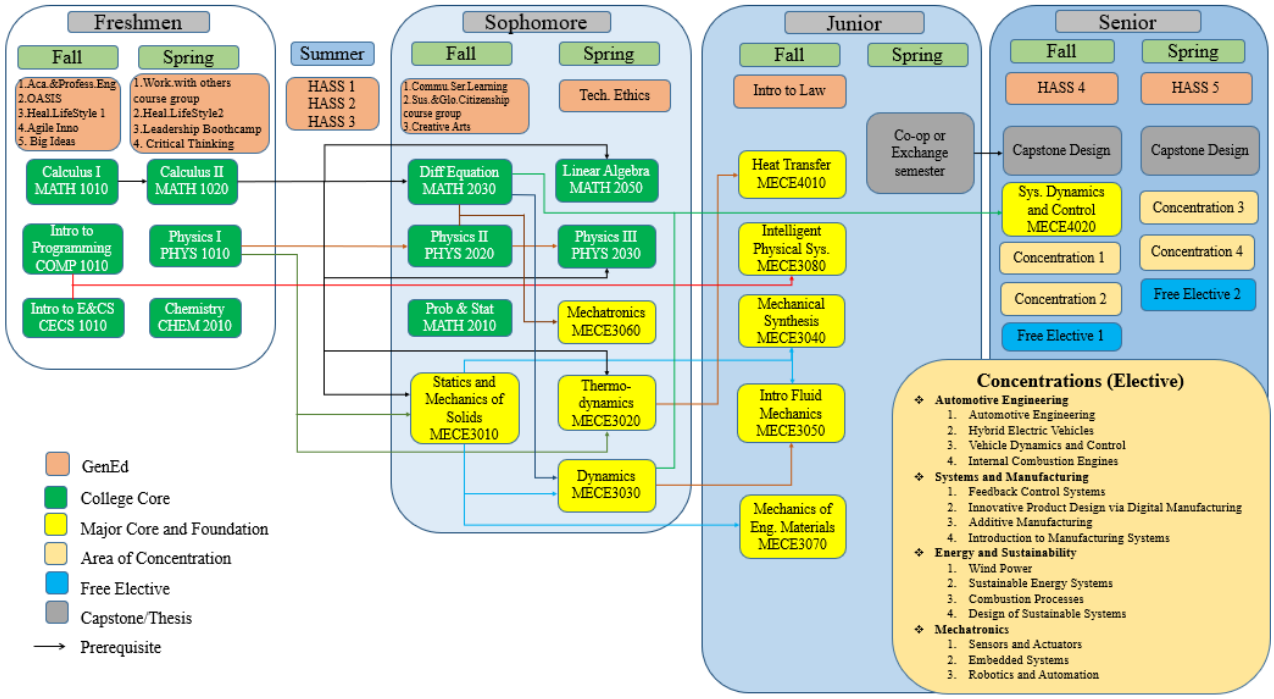
- *[1] Student can take ENGL1011 Fundamentals of Academic Writing to fulfil "Working with Others"*
- *[2] Student can take ARTS1010 Art Appreciation and MUSI1010 Music Appreciation to fulfil "Creative Arts"*

(**) For international students:

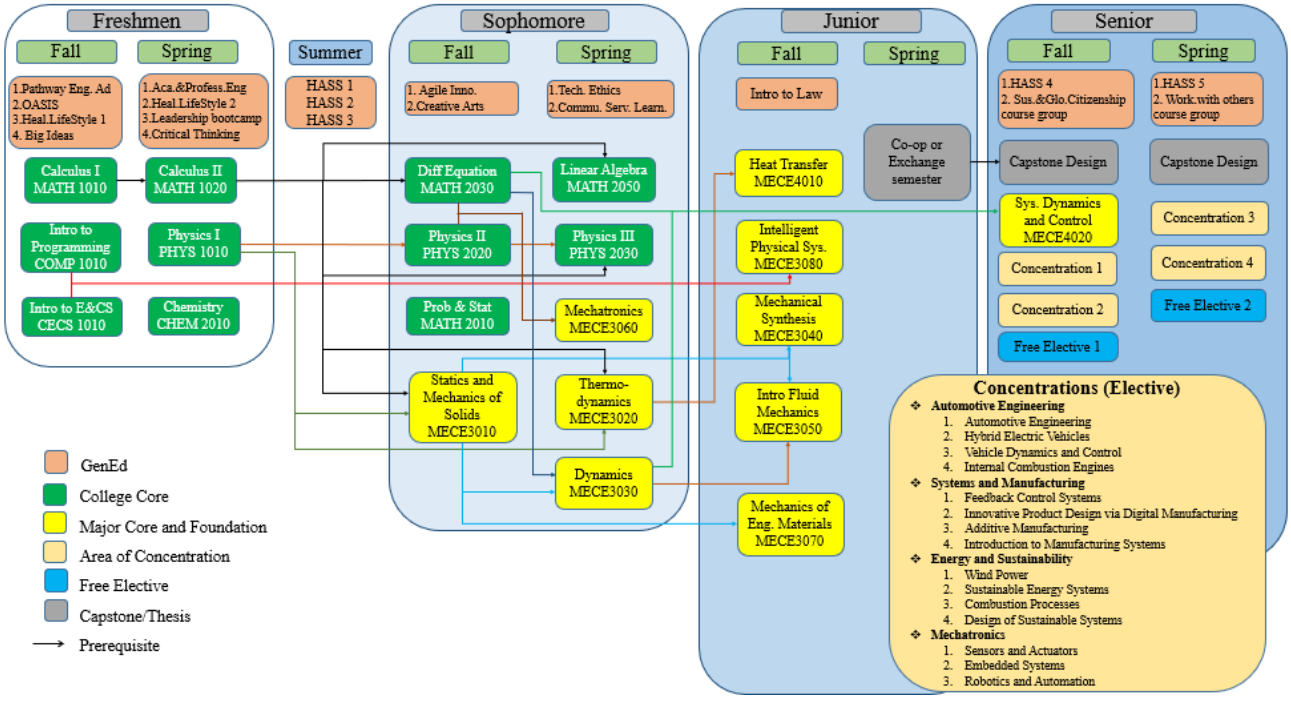
- International students are required to take ideology courses, including: History of the Communist Party, Ho Chi Minh Ideology, Scientific Socialism, Marxism-Leninism Political Economy, Marxism-Leninism Philosophy (In line with Decision No. 494/QĐ-TTg, issued on June 24, 2002, by the Prime Minister).
- International students are exempted from National Defense Education (in line with Circular 30/2018/TT-BGDĐT issued by the Ministry of Education and Training on December 24, 2018). Students may select other alternative courses (ie. Vietnam: History and Cultures I/II; Vietnamese Language; or other electives); to meet the required credits for graduation (at least 120 credits for a 4-year program and at least 180 credits for a 6-year program).

3.3 Curriculum Planner

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



Program frame work (Main track)



Program frame work (Pathway track)

❖ Main track

Undergraduate Mechanical Engineering Curriculum		VinCore	College Core	Major core and Foundation	Area of Concentration	Practice/ Internship	Graduation Thesis/ Capstone
Year 1 Fall	Calculus I		4				
	Introduction to Programming		4				
	Introduction to Engineering and CS		4				
	Agile Innovation & Entrepreneurship	2					
	Academic and Professional Writing	2					
	Big Ideas	2					
	OASIS	Non-Credit					
	Healthy Lifestyle 1	Non-Credit					
Total Semester Credits			**18**				
Year 1 Spring	Calculus II		4				
	Physics I		4				
	Chemistry		3				
	Critical and Creative Thinking	2					
	Working with others course group	2					
	Leadership and Teambuilding Bootcamp	2					
	Healthy Lifestyle 2	Non-Credit					
Total Semester Credits			**17**				
Summer 1	HASS course 1	3					
	HASS course 2	2					
	HASS course 3	2					
Total Semester Credits			**7**				
Year 2 Fall	Differential Equations		3				
	Physics II		3				
	Probability and Statistics		4				
	Community Service Learning	Non-credit					
	Sustainability and Global Citizenship course group	2					
	Creative Arts	2					
	Statics and Mechanics of Solids			4			
Total Semester Credits			**18**				
Year 2 Spring	Linear Algebra		4				
	Physics III		2				
	Dynamics			3			
	Thermodynamics			3			
	Mechatronics			3			
	Technology Ethics	2					
Total Semester Credits			**17**				
Summer 2	Internship or exchange program					Non Credit	
Year 3 Fall	Mechanical Synthesis			4			
	Introductory Fluid Mechanics			3			
	Intelligent Physical Systems (interdisciplinary Design project)			3			
	Mechanics of Engineering Materials			3			
	Heat Transfer			3			
	Introduction to Law	2					
Total Semester Credits			**18**				
Year 3 Spring	**Co-op semester (No credit)**						
Total Semester Credits			**0**				
Summer 3	Internship or exchange					No credit	
Year 4 Fall	Capstone Design						3
	System Dynamics and Control			3			
	Concentration 1				3		
	Concentration 2				3		
	HASS course 4	2					
Total Semester Credits			**14**				
Year 4 Spring	Capstone Design						3
	Concentration 3				3		
	Concentration 4				3		
	HASS course 5	2					
Total Semester Credits			**11**				

Total Program Credit Hours	**120**

Credit Hour Distribution	**31**	**39**	**32**	**12**	**0**	**6**
	GenED Core	**College Core**	**Major core and Foundation**	**Area of Concentration**	**Practice/ Internship**	**Graduation Thesis/ Capstone**

❖ Pathway track:

Undergraduate Mechanical Engineering Curriculum		VinCore	College Core	Major core and Foundation	Area of Concentration	Practice/ Internship	Graduation Thesis/ Capstone
Year 1 Fall	Calculus I		4				
	Introduction to Programming		4				
	Introduction to Engineering and CS		4				
	Big Ideas	2					
	Pathway English Advanced	Non-Credit					
	OASIS	Non-Credit					
	Healthy Lifestyle 1	Non-Credit					
Total Semester Credits			**14**				
Year 1 Spring	Calculus II		4				
	Physics I		4				
	Chemistry		3				
	Academic and Professional Writing	2					
	Critical and Creative Thinking	2					
	Leadership and Teambuilding Boothcamp	2					
	Healthy Lifestyle 2	Non-Credit					
Total Semester Credits			**17**				
Summer 1	HASS course 1	3					
	HASS course 2	2					
	HASS course 3	2					
Total Semester Credits			**7**				
Year 2 Fall	Differential Equations		3				
	Physics II		3				
	Probability and Statistics		4				
	Agile Innovation & Entrepreneurship	2					
	Creative Art	2					
	Statics and Mechanics of Solids			4			
Total Semester Credits			**18**				
Year 2 Spring	Linear Algebra		4				
	Physics III		2				
	Dynamics			3			
	Thermodynamics			3			
	Mechatronics			3			
	Community Learning Service	Non-credit					
	Technology Ethics	2					
Total Semester Credits			**17**				
Summer 2	Internship or exchange program					Non Credit	
Year 3 Fall	Mechanical Synthesis			4			
	Introductory Fluid Mechanics			3			
	Intelligent Physical Systems (interdisciplinary Design project)			3			
	Mechanics of Engineering Materials			3			
	Heat Transfer			3			
	Introduction to Law	2					
Total Semester Credits			**18**				
Year 3 Spring	**Co-op semester (No credit)**						
Total Semester Credits			**0**				
Summer 3	Internship or exchange					No credit	
Year 4 Fall	Capstone Design						3
	System Dynamics and Control			3			
	Concentration 1				3		
	Concentration 2				3		
	Sustainability and Global Citizenship cours	2					
	HASS course 4	2					
Total Semester Credits			**16**				
Year 4 Spring	Capstone Design						3
	Concentration 3				3		
	Concentration 4				3		
	Working with others course group	2					
	HASS course 5	2					
Total Semester Credits			**13**				

Total Program Credit Hours	**120**

Credit Hour Distribution	**31**	**39**	**32**	**12**	**0**	**6**
	GenED Core	**College Core**	**Major core and Foundation**	**Area of Concentration**	**Practice/ Internship**	**Graduation Thesis/ Capstone**

3.4 Course Descriptions

ENTR1022 Agile Innovation and Entrepreneurship

Credit: 2

Pre-requisite: None

On successful completion of this course, students will be able to:

1. Explain how an entrepreneurial mindset supports and accelerates innovation and growth in the contexts of businesses, industries, and countries.

2. Evaluate the multifaceted nature of entrepreneurship in Vietnam and internationally, and how it impacts the economy, society, and environment. Have access to insights on VinGroup's governance principles (the 6 Hóa).

3. Recommend strategies to evaluate the entrepreneurial mindset, values, and behaviors, and to further develop the entrepreneurial mindset, both individually and organizationally.

4. Grow your own entrepreneurial mindset and innovation-related skills, including identifying and evaluating opportunities, taking calculated risks, solving problems creatively, communicating effectively, and influencing stakeholder groups.

5. Demonstrate the ability to work productively in teams to collaboratively explore opportunities, generate ideas, and find and communicate solutions to a predefined challenge during the course hackathon.

IDEA1010/11/12 Series: Big Ideas (X)

2 credits

Pre-requisite: N/A

On successful completion of this course, students will be able to:

1. Describe and explain a “big idea”, which may be a new solution to a problem, a disrupting technology, or an innovative method or way of doings things

2. Identify the implications of a big idea for everyday life or a professional setting

3. Develop a strategy for using a big idea to improve an existing approach or create a new application

4. Evaluate the application of a big idea, including an assessment of its positive impacts, negative impacts, and mitigating strategies for the theme of the year

TECH1010 Technology Ethics

2 credits

Pre-requisite: N/A

On successful completion of this course, students will be able to:

1. Understand and explain the principles and values applied to technology, including privacy and data protection, algorithmic fairness and bias, digital inclusion, accountability and transparency, sustainability, and ethical AI and machine learning)

2. Identify uses of technology that produce unethical behavior or harm to users, society, or the environment

3. Apply relevant ethical theories to moral dilemmas involving technology

4. Evaluate different responses to ethical practice in technologies and justify an opinion based on ethical theory

COSL1010 Community Service Learning

45 hours

Pre-requisite: N/A

On successful completion of this course, students will be able to:

1. Define and understand the essential components of service learning, including benefits, impact, and key attributes.

2. Critically reflect on social issues and UNESCO's sustainable development goals (SDGs) withreference to a planned service project

3. Plan and implement a service project in accordance with local laws and regulations

4. Reflect on the outcomes of that service project and how it could have been improved

5. Develop sensitivity and empathy to local community members

CECS1031 Computational Thinking

2 credits

Pre-requisite: N/A

On successful completion of this course, students will be able to:

1. Identify and analyze problems from life and business in order to determine computational solutions.

2. Break down problems into logical steps and data requirements.

3. Use basic data structures and algorithms for problem-solving.

4. Design simple algorithms and computational models.

5. Implement solutions using basic programming skills.

6. Evaluate and optimize computational solutions.

ENGL1030 Academic and Professional Writing

2 credits

Pre-requisite: N/A

On successful completion of this unit, students will be able to:

1. Identify and explain core attitudes, values, and practices of academic culture and how academic writing reflects these.

2. Reflect critically on the differences between academic and opinion writing and apply this understanding in the composition of academic essays, including referencing, quoting, and paraphrasing.

3. Evaluate the differences between academic and professional writing in terms of style, purpose, target audience, and techniques.

4. Develop your clear, concise, and well-structured writing skills, focusing on the most critical documents and situations in academic and professional work such as academic essays, newspaper articles, business reports, proposals, speeches...

5. Use AI to develop, enhance, and revise writing in both academic and professional contexts.

CECS1050 Introduction to Data Literacy

2 credits

Pre-requisite: N/A

On successful completion of this course, students will be able to:

1. Read, understand, create, and communicate data as information.

2. Analyze and visualize data using tools like Excel and Python.

3. Understand the importance of data in business strategy and apply data-driven insights for decision-making.

4. Develop skills to improve data collection designs and ensure data quality.

5. Utilize statistical methods and probability to interpret, present and effectively tell stories about data.

CECS1040 Introduction to AI Literacy

2 credits

Pre-requisite: N/A

On successful completion of this course, students will be able to:

1. Understand basic AI principles, including machine learning and neural networks.

2. Use AI tools like ChatGPT for work and study tasks.

3. Recognize ethical implications, such as data privacy and algorithmic bias.

4. Apply AI to improve efficiency and innovation in academic and professional settings.

5. Design and evaluate user interfaces for better human-AI interaction

ENGL1040 Interpersonal and Multimedia Communication

2 credits

Pre-requisite: N/A

On successful completion of this course, students will be able to:

1. Identify and explain the fundamental concepts, scope, and diversity of oral and visual communication.

2. Identify communication expectations based on an understanding of different professional audiences and contexts and apply this knowledge in delivering communication.

3. Demonstrate responsible, ethical, and respectful attitudes as the field undergoes disruptive changes fueled by rapid technological advancements.

4. Develop your own oral communication skills in key situations, from speeches to conversation, discussion, giving feedback.

5. Grow your skills in developing digital content for multimedia, including presentations, pitches, blog posts, viral videos, podcasts, and basic media management.

MANA1011 Introduction to Managing Skills

2 credits

Pre-requisite: N/A

On successful completion of the course, students will be able to:

1. Apply the SMART technique to define specific, measurable, achievable, relevant, and time-bound goals, ensuring clarity and focus on their objectives.

2. Develop skills to effectively organize tasks and prioritize them based on importance and urgency, facilitating efficient and systematic progress towards achieving objectives.

3. Understand how to assign tasks based on team members' individual strengths, skills, and expertise, ensuring optimal use of resources, and enhancing team performance.

4. Learn to create and manage project schedules, monitor progress, and employ motivational techniques to keep team members engaged and productive, overcoming challenges and maintaining momentum.

5. Acquire the ability to give professional, accurate, and timely feedback, fostering a positive energy and environment within the team.

HASS1100 Introduction to International Relations

2 credits

Pre-requisite: N/A

On successful completion of this course, students will be able to:

1. Know the main actors, structures, and processes of international relations

2. Understand the basic theoretical principles of international relations and compare the competing underlying frameworks on human and social nature

3. Identify the respective objectives of international organizations in international politics, collaboration, and cooperation

4. Explore a case study, problem-solving scenario or dilemma involving international relations and devise a strategy/solution supported by theory and solid argumentation

5. Critically assess alternative strategies and points of view on complex scenarios requiring international relations

ARTS1030 Art Appreciation and Application

2 credits

Pre-requisite: N/A

On successful completion of this course, students will be able to:

1. Demonstrate an understanding and appreciation of arts and visual arts in general, including their function, and historical, religious, cultural, social, and environmental contexts and relevance;

2. Understand and define the basic principles of arts, visual arts, and design; explain and analyze a work of art from an informed and objective viewpoint, its physical attributes and formal construction;

3. Identify how art works are created and processed;

4. Make a reference to the significance and application of the arts in students' own field of studies and interests;

5. Analyze Vietnam arts and situate Vietnam arts in the global context.

PERF1010 Artistic Performance and Application

2 credits

Pre-requisite: N/A

On successful completion of this course, students will be able to:

1. Show improved skill in their chosen artistic field (e.g., music, dance, theatre, visual arts) and express their creativity and individuality through performance(s).

2. Evaluate and discuss different forms of artistic performance, identifying key elements and techniques, and write reflective assessments on their personal artistic development.

3. Work well with peers to create and perform artistic pieces, and effectively give and receive constructive feedback.

4. Clearly communicate the artistic vision and choices behind their performances both verbally and in writing (if required) and develop their skills in presenting artistic work to an audience, including stage presence and audience engagement.

5. Explore and appreciate a variety of artistic traditions from around the world, with a special focus on Vietnamese culture, and place their own artistic work in a wider cultural and historical context.

6. Plan, organize, and complete an artistic performance project from start to finish, demonstrating good time management and organizational skills.

7. Understand and apply ethical considerations in artistic performance, including respecting intellectual property and cultural sensitivities, and behave professionally during rehearsals, performances, and collaborative projects.

ENGL1030 Academic and Professional Writing

Credit: 2

Pre-requisite: NA

On successful completion of this unit, students will be able to:

1. Identify and explain core attitudes, values, and practices of academic culture and how academic writing reflects these.

2. Reflect critically on the differences between academic and opinion writing and apply this understanding in the composition of academic essays, including referencing, quoting, and paraphrasing.

3. Evaluate the differences between academic and professional writing in terms of style, purpose, target audience, and techniques.

4. Develop your clear, concise, and well-structured writing skills, focusing on the most critical documents and situations in academic and professional work such as academic essays, newspaper articles, business reports, proposals, speeches...

5. Use AI to develop, enhance, and revise writing in both academic and professional contexts.

ENGL1011 Fundamentals of Academic Writing

Credit: 3

Pre-requisite: 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.

LEAD1031: Leadership and Teambuilding Boot 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: OASIS - Orientation, Advising, Skills, Identity & Diversity, and Spirit of Pay it Forward

Non-credit

Pre-requisites: None

OASIS, which stands for Orientation, Advising, Skills, Identity & Diversity, and Spirit of Pay it Forward, is an integral, non-credit-bearing mandatory component of the Co-curriculum Program and plays an important role as one of the graduation criteria.

OASIS is a distinctive signature program of VinUni that holds a registered trademark. Its primary objective is to cultivate a self-leadership mindset and equips students with essential skills, facilitating their transformation from high school students into effective university scholars, responsible global citizens, and be ready for future career. OASIS is implemented in the first 4 years of bachelor's degree to ensure there

is enough time for students to reflect and practice their own self-leadership development, especially in developing essential qualities for work and life, including self-confidence, self-esteem, self-determination, and self-control.

LAW1010 Introduction to Law

2 credits

Pre-requisites: None

This course is an introduction to the concept and role of law which considers the nature of the rule of law and its relationship with morality, ethics, politics, and human rights. It provides students with general knowledge of the law that will serve as a helpful foundation for understanding how the law interacts with other disciplines that they study and pursue in the future. The course covers various aspects from legal theory including the notions of law, rules and legal systems to comparative legal analysis between different bodies of law, branches of international law as well as different means of settling disputes, either at municipal courts or other international forums worldwide. Of these, it focuses on the topic of Vietnamese civil law to help students gain familiarity with fundamental concepts and issues relating to contract formation, implementation and remedies in accordance with Vietnamese law. Throughout the course, students develop critical analysis and problem solving, workin-group and presentation skills, research literacy in law through theoretical lectures, case law analysis, individual and team assignments, and experiential learning in the form of legal simulation or moot court projects.

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 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.

PHYS2010 Physics I

4 credits

Pre-requisites: Calculus (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:

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:

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).

MECE3010 Statics and Mechanics of Solids

4 credits

Pre-requisites: Physics I, Calculus II

This course covers principles of statics, force systems, and equilibrium in solid structures. Topics include free body diagrams in two and three dimensions; frames; mechanics of deformable solids; stress and strain; axial force; shear force, bending moment, and torsion in bars and beams; thermal stress; pressure vessels; statically indeterminate problems; buckling and yielding.

MECE3020 Thermodynamics

3 credits

Pre-requisites: Physics I, Calculus II

This course presents the definitions, concepts, and laws of thermodynamics. Topics include the first and second laws, thermodynamic property relationships, and applications to vapor and gas power systems, refrigeration, and heat pump systems. Examples and problems are related to contemporary aspects of energy and power generation and to broader environmental issues.

MECE3030 Dynamics

3 credits

Pre-requisites: Statics and Mechanics of Solids, Differential Equations, Corequisite: Linear Algebra

This course teaches Newtonian dynamics of a particle, systems of particles, rigid bodies, simple mechanisms, and simple harmonic oscillators. Impulse, momentum, angular momentum, work, and energy. Two-dimensional (planar) kinematics

including motion relative to a moving reference frame. Three-dimensional rigid-body dynamics are also introduced. Setting up the differential equations of motion and solving them both analytically and numerically with MATLAB. In-lecture laboratory demonstrations illustrate basic principles.

MECE3040 Mechanical Synthesis

4 credits

Pre-requisites: Statics and Mechanics of Solids, Corequisite: Dynamics

This course provides a hands-on introduction to the mechanical design process, from conceptualization through prototype construction and testing. Design projects provide experience in basic prototyping skills using machine tools, 3D printing, and laser cutting, as needed, as well as basic instruction in CAD and technical sketching.

MECE3050 Introductory Fluid Mechanics

3 credits

Pre-requisites: Statics and Mechanics of Solids, Dynamics

This course covers physical properties of fluids, hydrostatics, conservation laws using control volume analysis and using differential analysis, Bernoulli's equation, potential flows, simple viscous flows (solved with Navier-Stokes equations), dimensional analysis, pipe flows, boundary layers. Introduction to compressible flow.

MECE4010 Heat Transfer

3 credits

Pre-requisites: Introductory Fluid Mechanics

This course covers the following topics: steady and unsteady heat conduction; forced and free convection; external and internal flows; radiation heat transfer; and heat exchangers.

MECE3060 Mechatronics

3 credits

Pre-requisites: Physics II, Differential Equations

At the intersection of mechanical and electrical engineering, Mechatronics involves technologies necessary to create automated systems. This course introduces students to the functional elements of modern controlled dynamic systems. Topics include analog circuits - both passive and active components, filter design, diodes, transistors, MOSFETs and power amplification, pulse width modulation, transduction - mechanical and electro-mechanical devices such as electromagnetic systems, gear

trains, optical encoders, discretization, aliasing, and microprocessors and programming. Lab experiments culminate in the design, fabrication, and programming of a microprocessor-controlled robotic vehicle, which laboratory groups enter into a class-wide competition.

MECE3080 Intelligent Physical Systems

3 credits

Pre-requisites: Introduction to Engineering and Computer Science, Introduction to Programming

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.

MECE4020 System Dynamics and Control

3 credits

Pre-requisites: Differential Equations, Linear Algebra, Dynamics

This course teaches dynamic behavior of mechanical systems: modeling, analysis techniques, and applications; vibrations of single- and multi-degree offreedom systems; feedback control systems. Computer simulation and experimental studies of vibration and control systems.

MECE3070 Mechanics of Engineering Materials

3 credits

Pre-requisites: Statics and Mechanics of Solids

This course gives an introduction to the broad range of properties and behaviors of engineering materials as they relate to mechanical performance. Emphasis is placed on general states of stress and strain, on elasticity and combined loading effects. Failure criteria including yielding, fracture and fatigue are developed. A general introduction to the function/constraints/objectives approach to material selection associated with mechanical design is provided with candidate material systems coming from metals, polymers, ceramics and/or composites. A general overview of material processing will be presented within this context of material selection.

MECE3090 Automotive Engineering

3 credits

Pre-requisites: Dynamics https://classes.cornell.edu/browse/roster/FA17/class/MAE/3270

This course covers the analysis and design of vehicle components and vehicle systems. Emphasis on automobiles. Engines, transmissions, suspension, brakes, and aerodynamics are discussed. The course uses first principles and applies them to specific systems. The course is highly quantitative, using empirical and analytical approaches.

MECE4030 Hybrid Electric Vehicles

3 credits

Pre-requisites: Dynamics

This course covers electrified powertrain concepts, Energy for Transportation; environmental impact, APUs for hybrid electric vehicles, Modeling of power split devices for hybrid vehicles, Vehicle control hierarchy and power management, Modeling and analysis of series electric hybrid powertrains, Power electronic devices and motors, Modeling and analysis of split hybrid power-trains, Modeling and control issues of batteries, Major design issues and consideration of Hybrids …

MECE4040 Vehicle Dynamics and Control

3 credits

Pre-requisites: Dynamics

This course focuses on tire mechanics and provides a fundamental understanding of feedback control, vehicle handling and ride performance through the development, analysis and critical interpretation of vehicle/system models.

MECE4050 Internal Combustion Engines

3 credits

Pre-requisites: Thermodynamics

This course covers the analytical approach to the engineering problem and performance analysis of internal combustion engines. Topics include thermodynamics, combustion, heat transfer, friction, and other factors affecting engine power, efficiency, and emissions, design and operating characteristics of different types of engines.

MECE3100 Introduction to Manufacturing Systems

3 credits

Pre-requisites:

This course provides ways to analyze manufacturing systems in terms of material flow and storage, information flow, capacities, and times and durations of events. Topics include probability, inventory and queuing models, forecasting, optimization, process analysis, and linear and dynamic systems; flow planning, bottleneck characterization, buffer and batch-size tactics, seasonal planning, and dynamic behavior of production systems. This course also covers automation process, CAD/CAM/CAE and CIMS**.**

MECE4060 Innovative Product Design via Digital Manufacturing

3 credits

Pre-requisites:

This course combines lecture and laboratory on the new product development cycle: iterative design based on prototyping, testing, consumer feedback, and limitations set by mass manufacturing. The course instructs students on methods to identify product concepts for machine designs with commercial potential. Design teams will perform market analysis and explore the intellectual property space around their ideas and rapidly iterate them into a final prototype via digital manufacturing (e.g., 3D CAD files manifested via robotic printing or machining); advanced instruction on these tools will be given, and quantitative marketing will be used as feedback. Early stage prototypes will progress into more sophisticated designs. Scale-up (cost, pricing, tooling) considerations for mass manufacturing will be taken into account, as well as quantitative analysis of machine designs for the expected utility.

MECE4070 Additive Manufacturing

3 credits

Pre-requisites: Introductory Fluid Mechanics

This course teaches fundamental additive manufacturing, 3D printing approaches, including extrusion-based deposition, stereolithography, powder bed-based melting, and inkjet-based deposition. Cultivate a design for-additive manufacturing skillset for CAD and CAM methodologies to produce successful 3D prints.

MECE4080 Feedback Control Systems

3 credits

Pre-requisites: System Dynamics and Control

This course covers the analysis and design of linear systems in both the frequency and time domains. The course includes a laboratory that examines the modeling and

control of representative dynamic processes. The frequency domain aspects are analyzed via Laplace transforms, transfer functions, root locus, and frequency response methods. The time domain aspects are analyzed via state space models, stability, controllability, observability, state feedback, and observers.

MECE3110 Wind Power

3 credits

Pre-requisites: Introductory Fluid Mechanics

This course covers the main features of energy conversion by wind turbines. Emphasis on the characterization of the atmospheric boundary layer, the aerodynamics of horizontal axis wind turbines, and performance prediction. Structural effects, power train considerations, siting, and wind farm planning.

MECE4090 Sustainable Energy Systems

3 credits

Pre-requisites: Introductory Fluid Mechanics, Heat transfer

This course critically examines the technology of energy systems that will be acceptable in a world faced with global climate change, local pollution, and declining supplies of oil. The focus is on renewable energy sources (wind, solar, biomass), but other non-carbon-emitting sources (nuclear) and lowered-carbon sources (co-generative gas turbine plants, fuel cells) also are studied. Both the devices and the overall systems are analyzed.

MECE4100 Combustion Processes

3 credits

Pre-requisites: Introductory Fluid Mechanics, Heat transfer

This course gives an introduction to combustion and flame processes, with emphasis on fundamental fluid dynamics, heat and mass transport, and reaction-kinetic processes that govern combustion rates. Topics include thermochemistry, kinetics, vessel explosions, laminar premixed and diffusion flames, and droplet combustion. Optional topics may include complex combustion systems, turbulent flames, fuel cells, or combustion of solids.

MECE4110 Design of Sustainable Systems

3 Credits

Pre-requisites:

This course will focus on the analysis, design, and production of renewable energy (solar, wind, nuclear, hydro, and geothermal, etc.) systems, with a focus on understanding the critical material challenges as well as the design and manufacturing challenges of sustainable energy systems.

MECE4120 Sensors and Actuators

4 credits

Pre-requisites: Intelligent Physical Systems

This course aims to provide students with in-depth knowledge of sensors and actuators through the technologies, future advances, and their applications. Students will learn about instrumenting an engineering system by incorporating sensors, actuators, and associated interface hardware. This course treats the types of sensors, actuators, and interface hardware in separate chapters in which the operating principles, modeling, design considerations and integration, performance specifications, and applications of the individual components are discussed. Throughout the course, students are engaged with case studies, work examples, and exercises related to robotic manipulators, industrial machinery, vehicles, aircraft, thermal and fluid process plants, and computer components.

ELEC4020 Embedded Systems

4 credits

Pre-requisites: Digital Logic and Computer Organization or Mechatronics

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.

ELEC4060 Robotics and Automation

4 credits

Pre-requisites: Control Systems or Mechatronics

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.

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.