



CURRICULUM FRAMEWORK

PROGRAM CODE: 7480101

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

Applicable for the intake beginning in 2020 - 2021

(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 OVERVIEW

2.1 Program Profile

Name of the program degree	Bachelor of Science in Computer Science
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: 122 credits

2.2 Program Purpose

The purpose of the program is to develop computer scientists with a deep understanding of underlying computer science theoretical principles, software engineering practices and significant exposure to problem-solving, project-based, authentic and hands-on

learning experience which will prepare them for work and allow them to contribute to society as creative, innovative and personally well-rounded, proactively leading and advancing it.

2.3 Program Learning Goals and Program Learning Objectives

2.3.1 Program Educational Objectives

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

- 1 Apply basic knowledge of computer science principles and in-depth knowledge of specific computing topics (such as artificial intelligence, machine learning, or software engineering practice) to address the full range of technical and societal problems;
- 2 Conceive, design, and realize useful products, systems, and services, while properly respecting economic, environmental, cultural, life safety, and ethical standards or constraints;
- 3 Discover and apply new knowledge, and develop new tools for the practice of computer science or software development;
- 4 Be sensitive to professional and societal contexts, committed to ethical action, engaged in life-long learning and be prepared for future academic career, should they want one;
- 5 Be leaders with an entrepreneurial mindset, and effective communicators as members of multidisciplinary teams, both in the profession and in the community;
- 6 Engage with their communities, profession, the nation and the world.

2.3.2 Student Outcomes

Students should be able to:

- 1 analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions;
- 2 design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline;
- 3 apply computer science theory and software development fundamentals to produce computing-based solutions;
- 4 communicate effectively in a variety of professional contexts;

- 5 recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles;
- 6 function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

In addition, they should have:

- 7 an entrepreneurial mindset and an ability to lead themselves and others;
- 8 a recognition of the importance of traditional values and national pride as well as global awareness.

3. CURRICULUM STRUCTURE

3.1 Curriculum Composition

No.	Curriculum Components	Number of Credits	Credit Distribution (%/Total Credits)
I	GENERAL EDUCATION	24	20 %
I.1	<i>University Core Requirement</i>	10	8.3 %
I.2	<i>Distributional Requirement</i>	14	11.7 %
I.3	<i>Co-curricular Learning</i>	Non-credit	
II	PROFESSIONAL EDUCATION	96	80 %
II.1	<i>College Core Requirement</i>	28	23.3%
II.2	<i>Major (Discipline) Requirement</i>	32	26.7 %
II.3	<i>Area of Concentration (Elective)</i>	12	10 %
II.4	<i>Free Electives (minor*)</i>	14 (15*)	11.6 %
II.5	<i>Science Courses</i>	2	1.7%
II.6	<i>Course-related Projects</i>	2	1.7%
II.7	<i>Practice/Internship</i>	Non-credit	
II.8	<i>Graduation Thesis/Capstone</i>	6	5 %
	TOTAL	120 (122*)	100%

* *Instead of taking 13 credits of free electives, students have an option of taking 15 credits to fulfill the requirements of a minor*

3.2 Courses and Credit Distribution by Courses

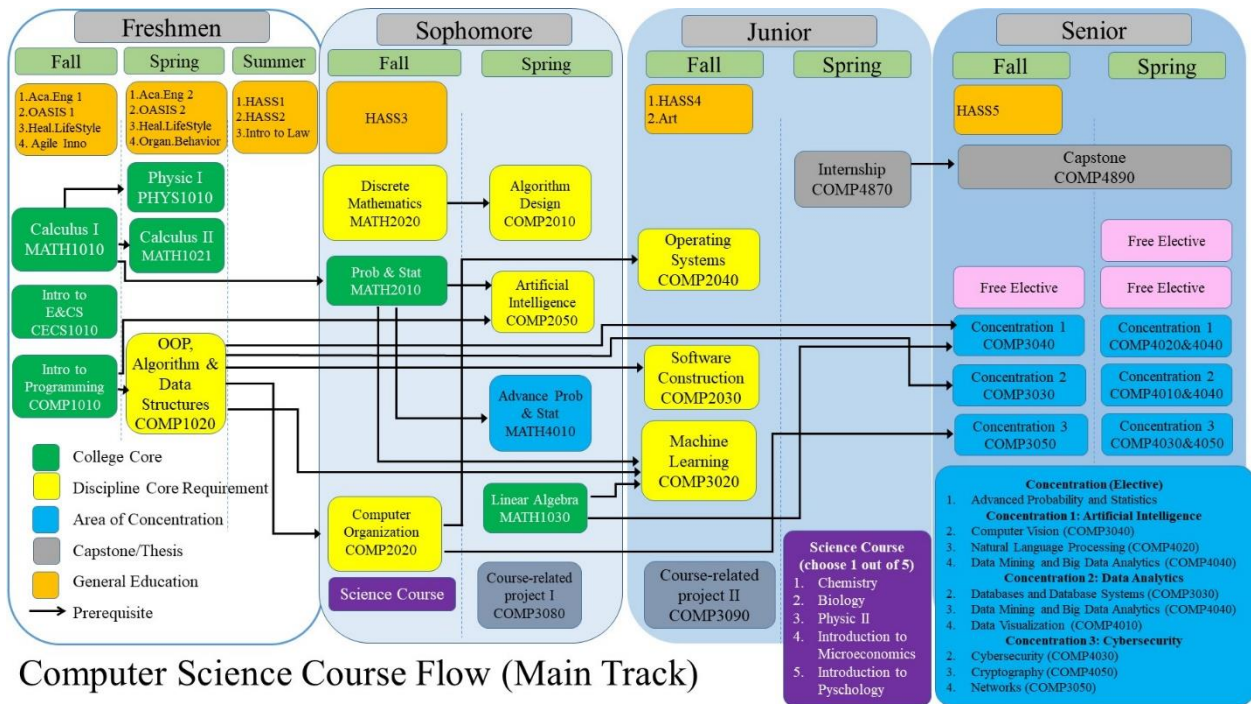
No	Course code	Name of Courses	Total	Credit Allocation	
				Theory	Practice
I	GENERAL EDUCATION (GenED)		24		
I.1	University Core Requirement		10		
1	ENGL1010	Academic English 1	3		
2	ENGL1020	Academic English 2	3		
3	LEAD1020	Organizational Behavior	2		
4	ENTR1020	Agile Innovation	2		
I.2	Distributional Requirement		14		
5	HASS1010	Marxism-Leninism Political Economy (Global Political Economy)	2		
6	HASS1020	Marxism-Leninism Philosophy (Philosophy Science and Society)	3		
7	HASS1030	Scientific Socialism (Politics and Social Change)	2		
8	HASS1050	History of the Communist Party (Vietnam: History and Culture I)	2		
9	HASS1040 /1041	Ho Chi Minh Ideology (Vietnam: History and Culture II)	2		
10	LAW1010	Introduction to Law	2		
11	ARTS1010	Culture - Arts	1		
I.3	Co-curricular Learning				
12	VCOR1010	OASIS	<i>Non-credit</i>		45 hrs
13	VCOR1020	Healthy Lifestyle	<i>Non-credit</i>		45 hrs
14	VCOR1030	National Defense Education	<i>Non-credit</i>		165 hrs
15	LEAD1030	Leadership Bootcamp	<i>Non-credit</i>		45 hrs
16	ENTR1010	Entrepreneurship Initiatives	<i>Non-credit</i>		45 hrs
17	COSL1010	Community Service Learning	<i>Non-credit</i>		45 hrs
18	GLEX1010	Global Experience	<i>Non-credit</i>		45 hrs
II	PROFESSIONAL EDUCATION				
II.1	College Core Requirement		28		
19	MATH1010	Calculus I	4	3	1
20	MATH1020	Calculus II	4	3	1
21	MATH2050	Linear Algebra	4	3	1
22	MATH2010	Probability and Statistics	4	3	1

23	PHYS1010	Physics I	4	3	1
24	CECS1010	Introduction to Engineering and Computer Science	4	2	2
25	COMP1010	Introduction to Programming	4	2	2
II.2	Major (Discipline) Requirement		32		
26	COMP1020	Object-oriented Programming and Data Structures	4	3	1
27	MATH2020	Discrete Mathematics	4	3	1
28	COMP3020	Machine Learning	4	3	1
29	COMP2020	Computer Organization	4	3	1
30	COMP3010	Algorithm Design	4	3	1
31	COMP2030	Software Construction	4	2	2
32	COMP2040	Operating Systems	4	3	1
33	COMP2050	Artificial Intelligence	4	3	1
II.3	Area of Concentration (Elective) (Select one)				
	Artificial Intelligence		12		
1	MATH4010	Advanced Probability and Statistics	3	2	1
2	COMP3040	Computer Vision	3	2	1
3	COMP4020	Natural Language Processing	3	2	1
4	COMP4040	Data Mining and Big Data Analytics	3	2	1
	Data Analytics		12		
1	MATH4010	Advanced Probability and Statistics	3	2	1
2	COMP3030	Databases and Database Systems	3	2	1
3	COMP4040	Data Mining and Big Data Analytics	3	2	1
4	COMP4010	Data Visualization	3	2	1
	Cybersecurity		12		
1	MATH4010	Advanced Probability and Statistics	3	2	1
2	COMP4030	Cybersecurity	3	2	1
3	COMP4050	Cryptography	3	2	1
4	COMP3050	Networks	3	2	1
II.4	Free Electives (or minor) (if student chooses a 3-credit course for science courses, the total credit of free electives is 13)		14 (15)		
II.5	Science Courses (required min. 2 credits of Physical Science courses)		2		
1	CHEM2010	Chemistry (Physical Science)	3	2	1
2	BIOL1010	Biology (Physical Science)	3	2	1
3	PHYS2020	Physics II (Physical Science)	3	2	1
4	ECON1010	Introduction to Microeconomics (Social Science)	3	3	
5	PSYC1010	Introduction to Psychology (Social Science)	2	2	
II.6	Course-related Projects		2		
1	COMP3080	Course-related Project 1	1		1

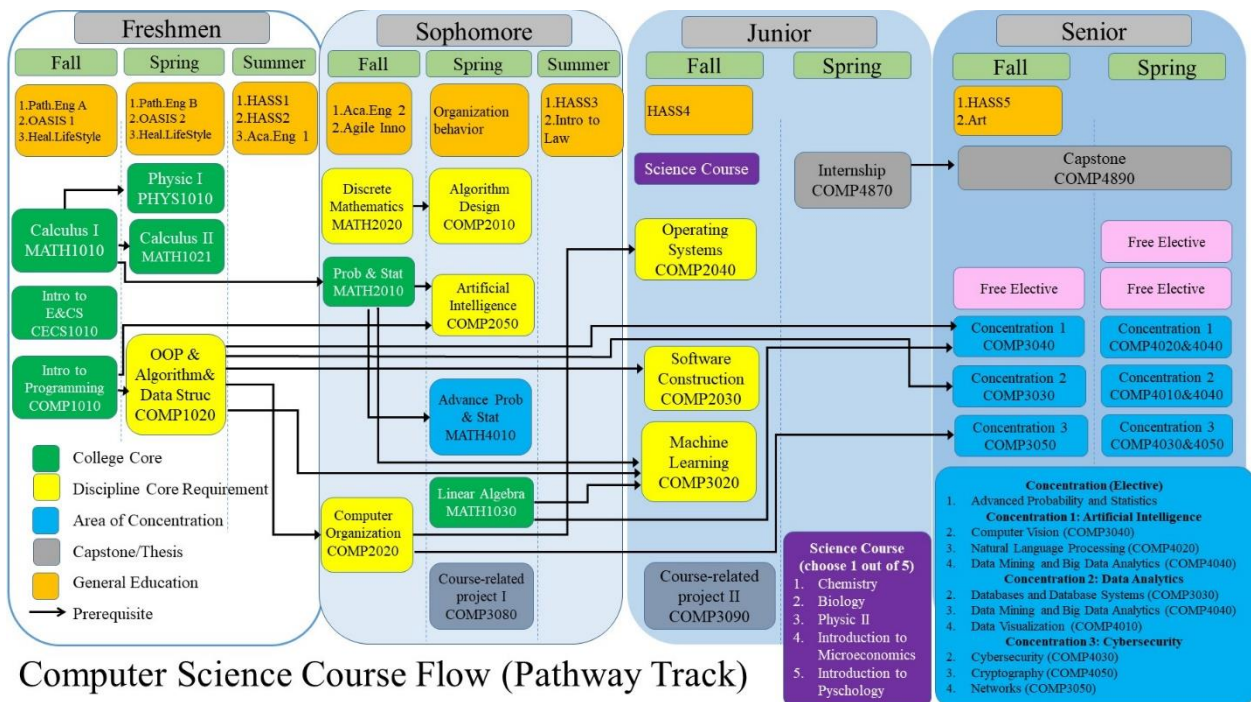
2	COMP3090	Course-related Project 2	1		1
II.7	Practice/Internship				
1	COMP4870	Internship	640 hrs		
II.8	Graduation Thesis/Capstone		6		
1	COMP4890	Capstone	6		

3.3 Curriculum Planner

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



Computer Science Course Flow (Main Track)



Computer Science Course Flow (Pathway Track)

Main track:

Undergraduate Computer Science Curriculum		GenED	College	Discipline	Concentration	Free	Science	Course-related	Practice/	Graduation
Main Track		Core	Core	Requirement		Elective	Courses	Projects	Internship	Thesis/ Capstone
Year 1 Fall	Calculus I		4							
	Introduction to Engineering		4							
	Introduction to Programming		4							
	Agile Innovation		2							
	Academic English 1		3							
	OASIS	Non-Credit								
	Healthy Lifestyle	Non-Credit								
Total Semester Credits			17							
Year 1 Spring	Calculus II		4							
	Physic I		4							
	Object-Oriented Programming and Algorithms			4						
	Academic English 2		3							
	Organizational Behavior		2							
	First Year Experience - OASIS 2	Non-Credit								
	Healthy Lifestyle	Non-Credit								
Total Semester Credits			17							
Summer 1	HASS course 1		3							
	HASS course 2		2							
	Introduction to Law		2							
			7							
Year 2 Fall	Probability and Statistics		4							
	Science Course						3			
	Discrete Mathematics			4						
	Computer Organization			4						
	HASS 3		2							
Total Semester Credits			17							
Year 2 Spring	Algorithm Desgin			4						
	Artificial Intelligence			4						
	Advance Probability and Statistics				3					
	Linear Algebra		4							
	Course-related Project							1		
Total Semester Credits			16							
Year 3 Fall	Operation System			4						
	Software Contruction			4						
	Machine Learning			4						
	Art		1							
	HASS4		2							
	Course-related Project							1		
Total Semester Credits			16							
Year 3 Spring	Internship (no credit)									
Total Semester Credits			0							
Year 4 Fall	HASS5		2							
	Concentration				3					
	Free Elective					4				
	Free Elective					3				
	Graduation Thesis/Capstone									3
Total Semester Credits			15							
Year 4 Fall	Concentration				3					
	Concentration				3					
	Free Elective					3				
	Free Elective					3				
	Graduation Thesis/Capstone									3
Total Semester Credits			15							
Total Program Credit Hours			120							
Credit Hour Distribution		24	28	32	12	13	3	2	0	6
	GenED	College	Discipline	Concentration	Free	Science	Course-related	Practice/	Graduation	
	Core	Core	Requirement		Electives	Courses	Projects	Internship	Thesis/ Capstone	

Pathway track:

Undergraduate Computer Science Curriculum		GenED	College	Discipline	Concentration	Free	Science	Course-related	Practice/	Graduation
Pathway		Core	Core	Requirement		Elective	Courses	Projects	Internship	Thesis/ Capstone
Year 1 Fall	Calculus I		4							
	Introduction to Engineering		4							
	Introduction to Programming		4							
	Pathway English Advaced A		6							
	OASIS 1	Non-Credit								
Healthy Lifestyle	Non-Credit									
Total Semester Credits			18							
Year 1 Spring	Calculus II		4							
	Physic I		4							
	Object-Oriented Programming and Algorithms			4						
	Pathway English Advaced B		6							
	First Year Experience - OASIS 2	Non-Credit								
Healthy Lifestyle	Non-Credit									
Total Semester Credits			18							
Summer 1	HASS course 1		3							
	HASS course 2		2							
	Academic English 1		3							
Total Semester Credits			8							
Year 2 Fall	Probability and Statistics		4							
	Discrete Mathematics			4						
	Computer Organization			4						
	Academic English 2		3							
	Agile Innovation		2							
Total Semester Credits			17							
Year 2 Spring	Algorithm Desgin			4						
	Artificial Intelligence			4						
	Advance Probability and Statistics				3					
	Linear Algebra		4							
	Organizational Behavior		2							
	Course-related Project								1	
Total Semester Credits			18							
Summer 2	HASS course 3		2							
	Introduction to Law		2							
Total Semester Credits			4							
Year 3 Fall	Operation System			4						
	Software Contruction			4						
	Machine Learning			4						
	Science Course						3			
	HASS4		2							
	Course-related Project								1	
Total Semester Credits			18							
Year 3 Spring	Internship (no credit)									
Total Semester Credits			0							
Year 4 Fall	HASS5		2							
	Art		2							
	Concentration				3					
	Free Elective					4				
	Free Elective					3				
Graduation Thesis/Capstone									3	
Total Semester Credits			17							
Year 4 Spring	Concentration				3					
	Concentration				3					
	Free Elective					3				
	Free Elective					3				
	Graduation Thesis/Capstone									3
Total Semester Credits			15							
Total Program Credit Hours			120							
Credit Hour Distribution		24	28	32	12	13	3	2	0	6
	GenED	College	Discipline	Concentration	Free	Science	Course-related	Practice/	Graduation	
	Core	Core	Requirement		Electives	Courses	Projects	Internship	Thesis/ Capstone	

3.4 Course Descriptions

ENTR1020 Agile Innovation

2 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 behaviors correlated with successful entrepreneurs and innovators. Skills to be taught include opportunity identification, idea generation, design thinking, building and leading an innovative team, optimizing creativity, seeking customer feedback, and prototyping. This hands-on course will allow students to refine their innovation skills and develop confidence in their creativity skill set. This course involves lectures and in-team innovation experience, generating an innovative product concept. The course is intended for a mix of students from various academic disciplines, such as medicine, nursing, engineering, business, real estate, and hospitality. The course will focus on identifying opportunities in a changing environment. Students will gain a broader perspective of both the challenges and opportunities related to technology and social change. (i.e. unmet customer needs and opportunities for future ventures). As part of the course all students will engage in a 3-day hackathon. For the hackathon event, students will form teams and will identify problems and generate solutions to real-world problems. Students will learn and apply team innovation processes, business model innovation, design thinking, creativity management, product pitches, data analysis, critical thinking, and product innovation. This course will also help students build their professional network.

ENGL1010 Academic English 1

3 credits

Pre-requisites: None or Pathway English Advanced B for Pathway track

This course is designed as a continuation of the Pathway English Program Advanced course to further develop students' competency in the English language and introduce and develop students' academic skills and literacies. Academic English 1 is the first of two courses in the General Education Program aimed at developing students' English language and skill competencies for English medium instruction at the university level. Students in this course will continue to develop their academic English language ability in Reading, Listening, Writing, and Speaking. While this course seeks to improve the overall capacity of the students' English language and

academic literacy skills, there is an emphasis on the development of academic writing at the essay level and oral communication skills to prepare students for Academic English 2 and long-term success in university-level coursework.

ENGL1020 Academic English 2

3 credits

Pre-requisites: Academic English 1

Academic English 2 reinforces and expands the language and academic skills developed in Academic English 1. Students will continue to expand and refine their range and accuracy of English but will now focus more intensively on the skill of writing. The principle aim of this course is to transition from the written essay to the research paper, augmenting students' academic writing skills to prepare them for the type of writing that is essential to their university studies. After identifying a key academic question, through a scaffolded and multistage approach, students will demonstrate a diversity of writing skills to create a coherent research paper and share their findings with an interdisciplinary audience through formal presentations. Students will further develop their academic inquiry skills, synthesizing and critically evaluating knowledge from various sources, creating new connections and ultimately crafting their own original ideas.

LEAD1020 Organization behaviors

2 credits

Pre-requisites: None

Course Description:

This course introduces students theoretically and practically to key facets of leadership in organizations. It lays the foundations for students' preparation to being influential leaders who can effectively work in local and global teams. The course covers aspects of self-leadership through developing self-awareness, critical thinking, resilience, and a global mindset. It builds interpersonal leadership through addressing perspective taking, conflict management, and effective feedback, and strengthens team leadership skills. Students develop skills through theoretical lectures, case study analysis, individual and team assignments, and self-reflection.

HASS1030 Scientific Socialism (Politics and Social Change)

2 credits

Pre-requisites: None

Introduction to Political Science is intended to be a survey course and thus, it covers briefly various topics in the broad field of political science. The purpose of this course is to provide a bird's-eye view of political science and social science inquiry, as well as equip students with the tools needed to explore the subject further on their own.

This course will familiarize students with important fundamental concepts in political science through concrete and exciting examples and cases studies, as well as stimulating and thought-provoking class activities. The goal is to build a lively learning environment where students are equipped with a systematic approach to learning political science and other kinds of social sciences. After the course, students will have the analytical, presentational, research and data analysis skills that are critical to higher-level specialized classes.

The class will first consider the fundamental concepts of political science and the scientific method. Next, we will cover substantive topics simultaneously from the point of view of sub-areas such as: Comparative Politics, International Relations, Marxist – Leninist Political Economy, and Scientific Socialism. By the end of the course, students should be fundamentally prepared to explore, research, and critique issues related to politics in the real world.

HASS1010 Marxism-Leninism Philosophy (Philosophy, Science and Society)

3 credits

Pre-requisites: None

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.

PSS 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. This course forms 3 credits out of a total of 12 credits dedicated to this requirement for higher education curriculum. 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.

HASS1020 Marxism-Leninism Political Economy (Global Political Economy)

2 credits

Pre-requisites: None

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.

HASS1050 History of the Communist Party (Vietnam: History and Cultures I)

2 credits

Pre-requisites: None

This course is designed to promote critical thinking, inquiry, creating skills by examining the social, cultural, economic and political development of Vietnam since the nineteenth century. From Confucian-inspired ideas of culture and society to the transformation wrought by French colonialism, the rise of the Vietnamese Communist Party, and the revolution of Ho Chi Minh ideology this course engages students to investigate how the Vietnamese have received, adopted, and adapted the various trends of thought introduced to the country throughout modern history.

HASS1040/1041 Ho Chi Minh Ideology (Vietnam: History and Cultures II)

2 credits

Pre-requisites: None

In the past two decades, Vietnam has achieved remarkable economic development while deepening its international ties and commitments. As a result, the country is enjoying a transformation rarely seen in human history. This makeover extends to fields as diverse as education, health care, technology, information, transportation, nutrition and real estate. But as Vietnam has developed, so have the complexities it faces, both at home and internationally. How do we make sense of it all?

In reality, Vietnam has long been a global crossroads. However, its history, culture and economy are rarely understood in this way. Vietnam History and Culture (II) considers Vietnam's significance as a point of international intersection since the arrival of French Colonialism to examine its history and contemporary events. Surveying modern Vietnam, the course explores such topics as French colonialism and the end of Dynastic Vietnam, Vietnamese responses to colonialism, the rise of nationalism and Communism, Hồ Chí Minh, the First and Second Indochina Wars, the post-1975 period, and Đổi Mới.

To tell this story, the course approaches events as William Shakespeare famously wrote, "All the world's a stage." In order to dive deep into events and the figures who participated in them, students will be challenged to reenact key moments and engagements on the classroom stage. Just who were Phan Thanh Giản and Phan Đình Phùng? How did Hồ Chí Minh experience September 2, 1945? And what was the air like in Geneva in 1954? Students will imagine themselves at these events and in these roles as well as a host of others.

This course is intended for students both with an aversion to history as well as advanced historians. As Vietnam's legendary economic historian Đặng Phong has argued, only with a strong understanding of history can leaders make appropriate decisions and policy. Therefore, this course aims to train future leaders of all fields, so they can better navigate and assess the complex issues facing Vietnam today as well as make informed judgements about what lies ahead.

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, work-in-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.

ARTS1010 Arts

1 credit

Pre-requisites: None

The Arts component of Vin University General Education Program seeks to cultivate the creative and affective senses in students. This is a part of our mission to provide a well-rounded and broad-based education. Through the "aesthetics," broadly defined, we hope to foster creativity and critical thinking skills among students either through an informed exposure to a particular art form and/or hands-on experiential learning of a particular art form. Being at the dawn of a new era of humanity where

digital technology permeates every aspect of our lives, it is critical that students are able to sensitively reflect on the importance of the Arts in society and re-discover what keeps us human.

The Arts component is offered as a singular one-credit course but available in a variety of renditions in each semester. Each course will focus specifically on one particular type of art form, a specific genre or an introductory set of skills. Students are required to complete one arts course offered by the General Education Program during the Third Year or before graduation.

VCOR1020 Healthy Lifestyle

No Credit

Pre-requisites: None

This component provides student with the knowledge to make better choices during their daily routines to build a healthy lifestyle. A healthy lifestyle doesn't just include external/internal physical wellbeing, but also good mental health. Students receive mentorship that guide and shape their perspective, showcasing the importance of having a well-balanced life. Fitness and exercise will be broken down to a process and science that allows students to have a greater understanding of what it takes to achieve their physical goals. Nutrition and diet will be taught to dispel the myths about how and what you should eat to achieve desired health results. Rounding out the course will be session about mental health, as a healthy body is nothing without a healthy mind. Having clarity of thought and the ability to effectively process information is a key trademark of a healthy lifestyle.

Topics will include workout/fitness styles and how to perform exercises properly and safely, results oriented diet design and nutrition fundamentals, stress management, goal setting, and time management. This course emphasizes practical application of the learned concepts in order to integrate subject matter into student daily routines. 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. Students learn through the use of group discussions, case studies, written assessments, 1 on 1 mentorship sessions, and most importantly practical applications in individual and group settings.

VCOR1030 National Defense Education

No Credit

Pre-requisites: None

National Defense Education, under MOET framework, plays a crucial role in building national pride, perseverance, and physical endurance among learners to secure the country's civil defense system. By challenging themselves with early morning rituals, followed by rigid mental and physical requirements as well as schedules, students develop their self-discipline, grit & durability. Various extracurricular activities are integrated to the curriculum to foster inclusivity, maturity & responsibility towards student families and their societies.

LEAD1030 Leadership Bootcamp

No Credit

Pre-requisites: None

The intensive 4-week Boot Camp instills foundational leadership values and skills into incoming students, while bringing the class together and creating esprit de corps. Students will learn and apply basic leadership concepts and skills through hands-on learning. Students will have to work individually and in team-based settings 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 obstacle courses, analyzing leadership case studies, and more. From developing self-awareness and thinking critically to innovating ideas and displaying resilience, students will learn fundamentals of Self, Interpersonal, and Team

Leadership through theoretical lectures, case study analysis, individual and team practical exercises, and self-reflection.

VCOR1010 First Year Experience - OASIS

No Credit

Pre-requisites: None

First Year Experience equips students with the necessary tools and problem solving methodologies as students embark on their university education. This course takes an integrated approach that incorporates both academic and nonacademic factors to create an inclusive and supportive community that addresses the social, emotional, and academic needs of students. The goal of this program is to enable students with a clear trajectory of where they want to go and what they want to do in terms of career opportunities and life beyond the walls of VinUni. Additionally, students will be encouraged to take full advantage of the plethora of relationships and resources

available to them. This course will prepare students in areas including social and emotional learning, 21st century skills, study skills and time management, research, self-confidence, positive psychology, goal setting, residential life, safety and wellness, and much more. The course material will be delivered through orientation, academic seminars, lectures from guest speakers and industry experts, peer interaction, immersion, and practical application.

ENTR1010 Entrepreneurship Initiatives

No Credit

Pre-requisites: None

The entrepreneurship program is a framework which provides students with the mindset and skillset to be successful not just in the context of a new venture but in a broad number of settings. While rigorous critical thinking and problem solving skills are developed, the program also prioritizes a growth mindset, curiosity, and initiative which help students to "ask the right questions" and identify new issues at local, regional, and global levels. Through a combination of multi-disciplinary coursework (in the credit requirements of General Education Program and E-Ship minor/major), labs, and co-curricular activities, students are exposed to entrepreneurship, business and economic issues with emphasis on issues affecting innovative ventures. Students learn through the use of case studies, self-assessments, experiential exercises, readings, discussions, papers, and group activities.

COSL1010 Community Service Learning

No Credit

Pre-requisites: None

This course aims at fostering students' sense of civic and social responsibility as well as their moral personality by engaging them to serve the primary and secondary school students (PSSS) through creatively designing activities, whereby they could apply their knowledge to the monitoring of the PSSS's health conditions and promote the correct and effective ways of enhancing their health awareness. This course is composed of lectures, seminars, workshops and on-site activities. This is a course where the students' problem-solving minds and community-serving hearts converge.

GLEX1010 Global Experience

No Credit

Pre-requisites: None

The module of global experience is a mandatory, non-credit bearing requirement of the GenED program. It is designed in alignment with the component of global awareness from the VinUni Graduate Attributes, forming a nexus that holistically coheres with the other Attributes.

A multi-faceted approach is adopted in enhancing students' global experience through a variety of effective pedagogical channels, such as Semester Abroad/exchange programs, community service learning abroad, cross culture experiences, summer programs and short-term overseas courses.

This module is offered through the collaboration of the General Education Program Committee, Office of Students Affairs and the Colleges.

MATH1010 Calculus I

4 credits

Pre-requisites: None

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 as well as to ordinary and partial differential equations. Topics include partial derivatives, double and triple integrals, line and surface integrals, vector fields, Green's theorem, Stokes' theorem, and the divergence theorem.

MATH2050 Linear Algebra

4 credits

Pre-requisites: None

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 using software to solve linear algebra problems.

MATH2010 Probability and Statistics

4 credits

Pre-requisites: Calculus I

This course teaches random variables, probability distributions, expectation, estimation, testing, experimental design, quality control, and regression. Other topics include density functions, expectation and variance, multidimensional random variables, and important distributions including normal, Poisson, exponential, hypothesis testing, confidence intervals, and point estimation using maximum likelihood, the method of moments, conditional probability and Bayesian reasoning.

MATH4010 Advanced Probability and Statistics

3 credits

Pre-requisites: Probability and Statistics

This course teaches advanced topics in probability and statistics. Topics include random processes, convergence of random processes, Markov Chains, Bayesian statistics, nonlinear regression.

CECS1010 Introduction to Engineering and Computer Science

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.

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

Course Description:

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

CHEM2010 Chemistry

3 credits

Pre-requisites: None

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 given to aspects and applications of chemistry most pertinent to engineering.

BIOL1010 Biology

3 credits

Pre-requisites: None

This course covers current topics in biology including the basics of molecular and cell biology, immunology, neurobiology, human genetics, biochemistry, biotechnology, personal genetics and genomics, metabolism, neuroscience, tissue repair and engineering, stem cells and evolution. Includes the topics of population growth, community structure, competition, mutualism and predation. Discusses social and ethical issues in modern biology.

ECON1010 Introduction to Microeconomics

3 credits

Pre-requisites: None

This course covers the fundamentals of microeconomics. Topics include consumer theory, producer theory, the behavior of firms, market equilibrium, monopoly, the role of the government in the economy, game theory, tragedy of commons and market failures.

PSYC1010 Introduction to Psychology

2 credits

Pre-requisites: None

This course covers provides a comprehensive overview of the scientific study of thought and behavior. It explores topics such as perception, communication, learning, memory, decision-making and the and the basics of neuroscience.

COMP1010 Introduction to Programming

4 credits

Pre-requisites: None

This course covers 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, the basics of object-oriented programming (classes, objects, types, sub-typing), and GUIs (graphical user interfaces).

COMP1020 Object-oriented Programming and Data Structures

4 credits

Pre-requisites: Introduction to Programming

This course covers program structure and organization, modular programming, advanced topics in object-oriented programming (abstract data types, polymorphism, interfaces, iterators), collections, basics of graphical user interfaces, recursion, data structures (lists, trees, stacks, queues, heaps, search trees, balanced

trees, hash tables, graphs), and basic graph algorithms. Java is the principal programming language.

MATH2020 Discrete Mathematics

4 credits

Pre-requisites: None

This course covers notions, techniques and algorithms of discrete mathematics with the special emphasis on sets and proof techniques, functions and relations, number theory, combinatorics, probability, logic, the basics of graph theory and the basics of cryptography.

COMP2020 Computer Organization

4 credits

Pre-requisites: Object-oriented Programming, Algorithms and Data Structures

This course provides an introduction to computer organization, systems programming and the hardware/software interface. Topics include instruction sets, computer arithmetic, datapath design, data formats, addressing modes, memory hierarchies including caches and virtual memory, I/O devices, bus-based I/O systems, and multicore architectures. Students learn assembly language programming and design a pipelined RISC processor.

COMP3010 Algorithm Design

4 credits

Pre-requisites: Theory of Computation

This course covers four major algorithm design techniques (greedy algorithms, divide and conquer, dynamic programming, and network flow), and algorithmic techniques for intractable problems, including identification of structured special cases, approximation algorithms, and local search heuristics. Applications are drawn from systems and networks, artificial intelligence, computer vision, data mining, and computational biology.

COMP2020 Software Construction

4 credits

Pre-requisites: Object-oriented Programming, Algorithms and Data Structures

This course covers the topics of abstract data types, abstractions functions, interfaces, revisits recursion and regular expressions and grammars. It deals with parser generators, concurrency, thread safety, programming for sockets and networking, queues and message passing, multithreading, locks and synchronization, map and filter, streams and laziness. The course introduces the area of information and data management and how software can be designed to improve data management. It covers testing, code review, version control, designing specifications, debugging and developing complex graphical user interfaces.

COMP2040 Operating Systems

4 credits

Pre-requisites: Computer Organization

This course covers systems programming and introductory operating system design and implementation. The basics of operating systems, namely structure, concurrency, scheduling, synchronization, memory management, filesystems, security and networking are covered. The course introduces parallel and distributed computing.

COMP2050 Artificial Intelligence

4 credits

Pre-requisites: Introduction to Programming; Probability and Statistics

This course covers the main areas of artificial intelligence, including symbolic and connectivist approaches to artificial intelligence, state search algorithms and biologically inspired optimization algorithms, Bayesian networks, the use of logic programming and inference algorithms for logical problems. As part of the course, students will learn about various approaches to representing uncertainty, get an introduction to the decision theory, planning and decision making under uncertainty, and learn how to apply various artificial intelligence methods to different problems. The course will consider ethical and societal issues related to artificial intelligence.

COMP3020 Machine Learning

4 credits

Pre-requisites: Linear Algebra, Probability and Statistics, Object-oriented Programming, Algorithms and Data Structures

This course covers the principles and algorithms for turning training data into effective automated predictions. It covers the topics such as representation, over-fitting, regularization, and generalization, clustering, classification, recommender problems, probabilistic modeling, reinforcement learning; and methods such as support vector machines and neural networks/deep learning.

COMP3030 Databases and Database Systems

4 credits

Pre-requisites: Object-oriented Programming, Algorithms and Data Structures

This course gives an introduction to relational and noSQL database systems. The topics covered include the relational model, relational algebra, entity-relationship model, schema design, normal forms, SQL, indexing, sorting, relational operators, query optimization, transactions, concurrency control, recovery, database design, and concepts and algorithms for building database management systems.

COMP3040 Computer Vision

3 credits

Pre-requisites: Machine Learning, Linear Algebra, Object-oriented Programming, Algorithms and Data Structures

This course teaches introduction to computer vision. The goal of computer vision is to compute properties of our world-the 3D shape of an environment, the motion of objects, the names of people or things-through analysis of digital images or videos. The course covers a range of topics, including 3D reconstruction, image segmentaion, object recognition, and vision algorithms fro the Internet, as well as key algorithmic, optimization, and machine learning techniques, such as graph cuts, non-linear least squares, and deep learning. This course emphasizes hands-on experience with computer vision, and several large programming projects.

COMP3050 Networks

3 credits

Pre-requisites: Computer Organization

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.

COMP4010 Data Visualization

3 credits

Pre-requisites: Introduction to programming, statistics and probability, data mining and big data analytics

This course teaches techniques and algorithms for creating effective visualizations of large datasets and their analytics, based on principles from graphic design, visual art, perceptual psychology and cognitive science. In addition to participating in class discussions, students will have to complete several short data analysis and visualization design assignments as well as a final project. Data visualisation tools such as Tableau are considered as lab exercises.

COMP4020 Natural Language Processing

3 credits

Pre-requisites: Machine Learning, Object-oriented Programming, Algorithms and Data Structures

This course covers the introduction to natural language processing (NLP), the goal of which is to enable computers to use human languages as input, output, or both. It examines NLP in context of including machine translation, automatic conversational assistants and Internet search. Possible topics include summarization, machine translation, sentiment analysis and information extraction as well as methods for handling the underlying phenomena (e.g., syntactic analysis, word sense disambiguation, discourse analysis, their shortcomings and solutions).

COMP4030 Cybersecurity

3 credits

Pre-requisites: Object-oriented Programming, Algorithms and Data Structures, Discrete Mathematics

This course covers the topics of technical and social understanding of how and why security and privacy matter, how to think adversarially, how (and how not) to design systems and products. Topics include user authentication, cryptography, malware,

behavioral economics in security, human factors in security, privacy and anonymity, side channels, decoys and deception, and adversarial modeling. Real-world systems and attacks, including Bitcoin, Stuxnet, retailer breaches, implantable medical devices, and health apps are covered. The course discusses societal and ethical issues in cybersecurity.

COMP4040 Data Mining and Big Data Analytics

3 credits

Pre-requisites: Linear Algebra, Object-oriented Programming, Algorithms and Data Structures, Machine Learning

This course covers the statistical aspects of data mining, the effective analysis of large datasets. It covers the process of building and interpreting various statistical models appropriate to such problems arising in scientific and business applications. Topics include preparing data for data mining and interpreting and representing knowledge from big data analysis. Assignments are done using one or more data mining.

COMP4050 Cryptography

3 credits

Pre-requisites: Theory of Computation, Linear algebra

This is an introductory course in Cryptography. Topics include one-way functions, encryption, digital signatures, pseudo-random number generation, zero-knowledge and basic protocols. The emphasis will be on fundamental notions and constructions with proofs of security based on precise definitions and assumptions.

COMP3080, COMP3090 Course-related project I and II

min 1 credit

Pre-requisites: Determined by the course lecturers

Courses for the project: Computer Organization, Algorithm Design, Operating Systems, Artificial Intelligence, Machine Learning, Human-Computer Interaction, Robotics, Cybersecurity and Data Mining and Big Data.

Students work in multidisciplinary teams on a course-related problem guided by the course instructor.

COMP4870 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).

COMP4890 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 computing design and implementation. 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 industry/academia and VinUni in accordance with ABET requirements. More specifically, the project involves the development of computing or information systems. The project should focus on advanced technologies, new applications, and their usefulness and benefit to the development of the economy and society. In this course, students work in teams of 3 to 5, where some students may be in other programs. They will work 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 formal group meeting and for required classes. They should be able to deliver their work and contribution to the project and engage in professional dialogue about their project during formal presentations.