VINUNIVERSITY

CURRICULUM FRAMEWORK

PROGRAM CODE: 7480101

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

Applicable for the intake beginning in 2022 - 2023

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

This curriculum framework has been reviewed and validated by Cornell University

Table of Contents

Contents

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: 127 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**	**27**	**22.5 %**
I.1	*University Core Requirement*	*12*	8.3 %
I.2	*Distributional Requirement*	*12*	14.2 %
I.3	*Co-curricular Learning*	*3*	2.5 %
II	**NATIONAL DEFENSE EDUCATION**		
III	**PROFESSIONAL EDUCATION**	**93**	**77.5 %**
III.1	*College Core Requirement*	30	25 %
III.2	*Major (Discipline) Requirement*	32	26.6 %
III.3	*Area of Concentration (Elective)*	12	10 %
III.4	*Free Electives (minor*)*	9 (15*)	7.5 %
III.5	*Science Courses*	2	1.7 %
III.6	*Course-related Projects*	2	1.7 %
III.7	*Practice/Internship*	Non-credit	
III.8	*Graduation Thesis/Capstone*	6	5 %
	TOTAL	**120 (127*)**	**100 %**

**** Instead of taking 9 credits of free electives, students have an option of taking 15 credits to fulfill the requirements of a minor***

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3.2 Courses and Credit Distribution by Courses

No	Course code	Name of Courses	Total	Credit Allocation	
				Theory	Practice
I	**GENERAL EDUCATION (GenED)**		**27**		
I.1	**University Core Requirement**		***12***		
1	ENGL1011	Fundamentals of Academic Writing [1]	3		
2	ENTR1021	Agile Innovation and Entrepreneurship [2]	3		
3	LEAD1030	Leadership and Teambuilding Boot Camp [3]	2		
4	THINK1010	Critical and Creative Thinking	2		
5	HASS1070	Cross Cultural Navigation	2		
6	VCOR1021/ 22	Healthy Lifestyle 1,2 [4]	Non-credit required (45 hours)		
I.2	**Distributional Requirement**		***12***		
1	HASS1010	Marxism-Leninism Political Economy (Philosophy, Science and Society) [5]	3		
2	HASS1020	Marxism-Leninism Philosophy (Global Political Economy) [6]	2		
3	HASS1030	Scientific Socialism (Politics and Social Change) [7]	2		
4	HASS1041/1 042	Ho Chi Minh Ideology (Vietnam: History and Cultures II) [8]	2		
5	HASS1050	History of the Communist Party (Vietnam: History and Cultures I) [9]	2		
6	ARTS1010	Art Courses [10] (Students select one course in the pool, i.e. ARTS1010, MUSI1010)	1		
I.3	**Co-curricular Learning**				
1	VCOR1010A /B	OASIS (Orientation – Academic Skills – Identity and Service)	3		
II	**NATIONAL DEFENSE EDUCATION (as required by the Government for Vietnamese citizens)**		**165 hours**		
III	**PROFESSIONAL EDUCATION**				
III.1	**College Core Requirement**		**30**		
1	MATH1010	Calculus I	*4*	*3*	*1*

2	MATH1020	Calculus II	*4*	*3*	*1*
3	MATH2050	Linear Algebra	*4*	*3*	*1*
4	MATH2010	Probability and Statistics	*4*	*3*	*1*
5	PHYS1010	Physics I	4	3	1
6	CECS1010	Introduction to Engineering and Computer Science	*4*	*2*	*2*
7	COMP1010	Introduction to Programming	*4*	*2*	*2*
8	LAW3010	Introduction to Law	*2*	*2*	
III.2	**Major (Discipline) Requirement**		**32**		
1	COMP1020	Object-oriented Programming and Data Structures	*4*	*3*	*1*
2	MATH2020	Discrete Mathematics	*4*	*3*	*1*
3	COMP3020	Machine Learning	*4*	*3*	*1*
4	COMP2020	Computer Organization	*4*	*3*	*1*
5	COMP3010	Algorithm Design	*4*	*3*	*1*
6	COMP2030	Software Construction	*4*	*2*	*2*
7	COMP2040	Operating Systems	*4*	*3*	*1*
8	COMP2050	Artificial Intelligence	*4*	*3*	*1*
III.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*
III.4	**Free Electives (or minor) (*if student chooses a 3-credit course for science courses, the total credit of free electives is 8)***		***9 (15)***		
III.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*

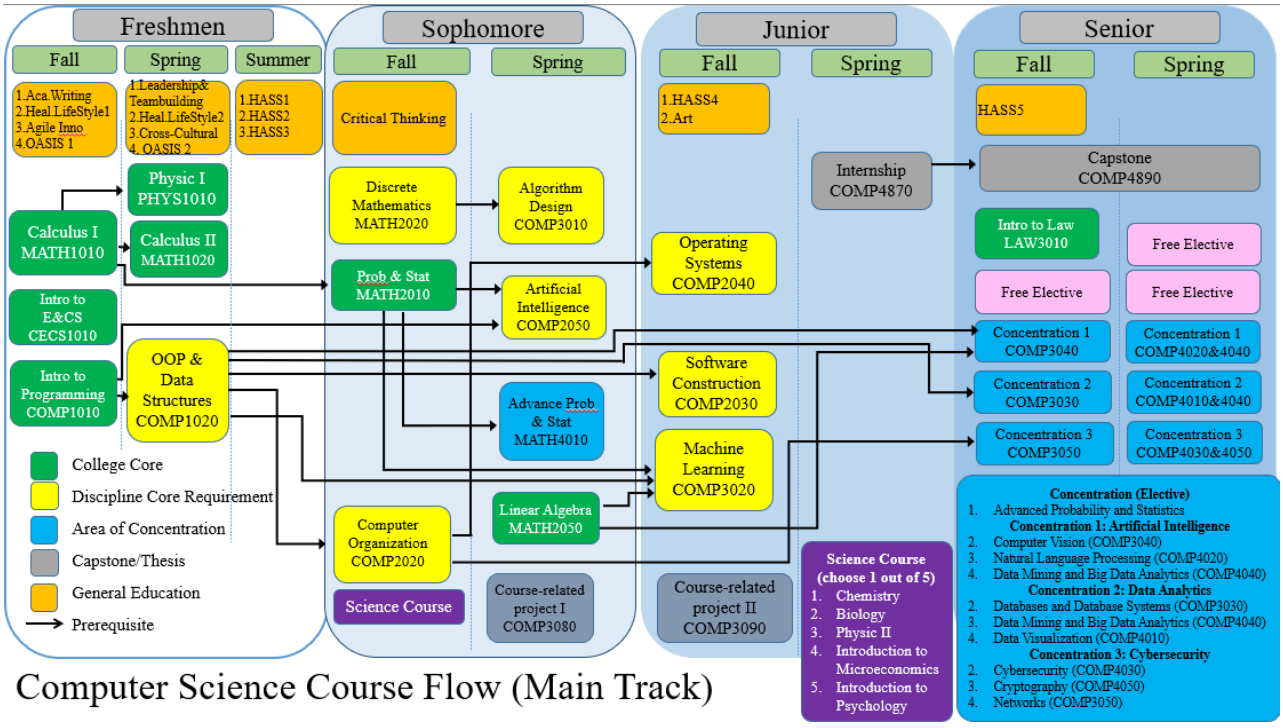
3	PHYS2020	Physics II (Physical Science)	*3*	*2*	*1*
4	ECON1010	Introduction to Microeconomics (Social Science)	*3*	*3*	
5	PSYC1010	Introduction to Psychology (Social Science)	*2*	*2*	
III.6	**Course-related Projects**		**2**		
1	COMP3080	Course-related Project 1	*1*		*1*
2	COMP3090	Course-related Project 2	*1*		*1*
III.7	**Practice/Internship**				
1	COMP4870	Internship	640 hrs		
III.8	**Graduation Thesis/Capstone**		**6**		
1	COMP4890	Capstone	6		

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

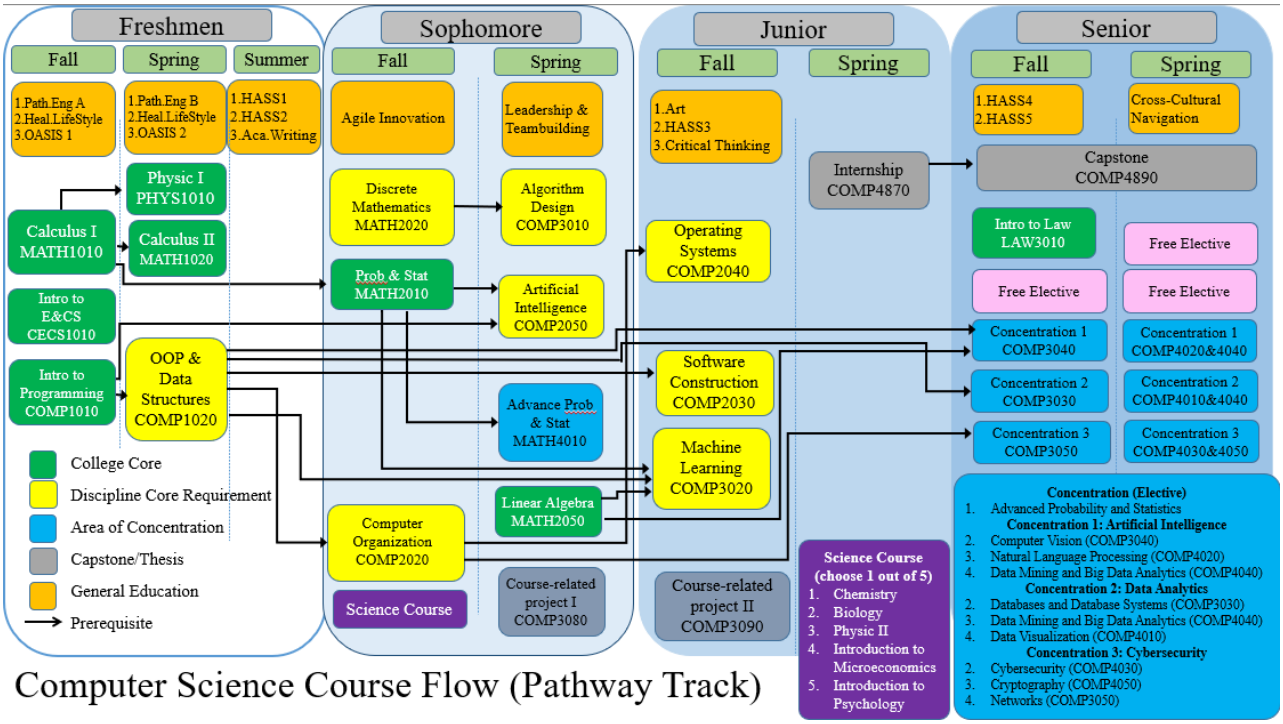
- [1] Academic English 1 (ENGL1010) and Academic English 2 (ENGL1020) applied to Cohorts 2020 and 2021. Since Academic Year 2022-2023, only one Academic English (3 credits) is compulsory for students, the other is optional. The name and code of the course is tentative and subject to change.
- [2] Agile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

3.3 Curriculum Planner

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



Computer Science Course Flow (Main Track)



Computer Science Course Flow (Pathway Track)

Main track:

Undergraduate Computer Science Curriculum Main Track		GenED Core	College Core	Discipline Requirement	Concentration	Free Elective	Science Courses	Course-related Projects	Practice/ Internship	Graduation Thesis/ Capstone
Year 1 Fall	Calculus I		4							
	Introduction to Engineering and CS		4							
	Introduction to Programming		4							
	Agile Innovation & Entrepreneurship	3								
	Academic English	3								
	OASIS -Part 1	1								
	Healthy Lifestyle 1	Non-Credit								
Total Semester Credits			**19**							
Year 1 Spring	Calculus II		4							
	Physics I		4							
	Object-Oriented Programming and Data Structures			4						
	OASIS- Part 2	2								
	Cross-cultural Navigation	2								
	Leadership Development	2								
	Healthy Lifestyle 2	Non-Credit								
Total Semester Credits			**18**							
Summer 1	HASS course 1	3								
	HASS course 2	2								
	HASS course 3	2								
			7							
Year 2 Fall	Probability and Statistics		4							
	Science Course						3			
	Discrete Mathematics			4						
	Computer Organization			4						
	Critical Thinking	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	Operating Systems			4						
	Software Contruction			4						
	Machine Learning			4						
	Art	1								
	HASS course 4	2								
	Course-related Project							1		
Total Semester Credits			**16**							
Year 3 Spring	**Internship (no credit)**									
Total Semester Credits			**0**							
Year 4 Fall	HASS course 5	2								
	Introduction to Law		2							
	Concentration				3					
	Free Elective					4				
	Graduation Thesis/Capstone									3
Total Semester Credits			**14**							
Year 4 Spring	Concentration				3					
	Concentration				3					
	Free Elective					4				
	Graduation Thesis/Capstone									3
Total Semester Credits			**13**							
	Total Program Credit Hours		**120**							
	Credit Hour Distribution	**27**	**30**	**32**	**12**	**8**	**3**	**2**	**0**	**6**

Pathway track:

Undergraduate Computer Science Curriculum Pathway Track		GenED Core	College Core	Discipline Requirement	Concentration	Free Elective	Science Courses	Course-related Projects	Practice/ Internship	Graduation Thesis/ Capstone
Year 1 Fall	Calculus I		4							
	Introduction to Engineering and CS		4							
	Introduction to Programming		4							
	Pathway English Advanced A	6								
	OASIS -Part 1	1								
	Healthy Lifestyle 1	Non-Credit								
Total Semester Credits			**19**							
Year 1 Spring	Calculus II		4							
	Physics I		4							
	Object-Oriented Programming and Data Structures			4						
	OASIS- Part 2	2								
	Pathway English Advanced B	6								
	Healthy Lifestyle 2	Non-Credit								
Total Semester Credits			**20**							
Summer 1	HASS course 1	3								
	HASS course 2	2								
	Academic English	3								
			8							
Year 2 Fall	Probability and Statistics		4							
	Science Course						3			
	Discrete Mathematics			4						
	Computer Organization			4						
	Agile Innovation & Entrepreneurship	3								
Total Semester Credits			**18**							
Year 2 Spring	Algorithm Desgin			4						
	Artificial Intelligence			4						
	Leadership Development	2								
	Advance Probability and Statistics				3					
	Linear Algebra		4							
	Course-related Project							1		
Total Semester Credits			**18**							
Year 3 Fall	Operating Systems			4						
	Software Contruction			4						
	Machine Learning			4						
	Art	1								
	Critical Thinking	2								
	HASS course 3	2								
	Course-related Project							1		
Total Semester Credits			**18**							
Year 3 Spring	**Internship (no credit)**									
Total Semester Credits			**0**							
Year 4 Fall	HASS course 4	2								
	HASS course 5	2								
	Introduction to Law		2							
	Concentration				3					
	Free Elective					4				
	Graduation Thesis/Capstone									3
Total Semester Credits			**16**							
Year 4 Spring	Concentration				3					
	Concentration				3					
	Cross-cultural Navigation	2								
	Free Elective					4				
	Graduation Thesis/Capstone									3
Total Semester Credits			**15**							
	Total Program Credit Hours		**132**							
	Credit Hour Distribution	**39**	**30**	**32**	**12**	**8**	**3**	**2**	**0**	**6**

3.4 Course Descriptions

ENGL1011: Fundamentals of Academic Writing

3 credits

Pre-requisites: None

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

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

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

ENTR1021: Agile Innovation & Entrepreneurship

3 credits

Pre-requisites: None

The purpose of this course is to provide students with a basic understanding of the entrepreneurial and innovation mindset and provide students the opportunity to learn about and develop skills and behaviors correlated with impactful entrepreneurs

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

LEAD1030: Leadership Development

2 credits

Pre-requisites: None

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

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

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

THINK1010 - Critical and Creative Thinking

2 credits

Pre-requisites: None

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

HASS1070: Cross-Cultural Navigation

2 credits

Pre-requisites: None

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

VCOR1021/22: Healthy Lifestyle 1, 2

Non-credit, required min 45 hours across Year

Pre-requisites: None

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

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

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

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

3 credits

Pre-requisites: None

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

VinUniversity, each course is designed to be delivered in the spirit of content-based language learning approach to help students both develop English language competency (focusing on speaking, listening and reading) and basic understanding of the content.

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

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

2 credits

Pre-requisites: None

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

development, modernization, and regional development in Vietnam's prospects in the world. Our case studies pay special attention to the immediate regions surrounding Vietnam, namely ASEAN, East Asia (in particular, China) and South Asia. In the third and final part of this course, we examine the expressions of global inequality and consider how individuals and communities within Vietnam can move forward in an ever-globalizing world.

HASS1030: Scientific Socialism (Politics and Social Change)

2 credits

Pre-requisites: None

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

What can be learned?

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

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

Broad outlines

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

Medium of learning

The guiding principle for learning at the Vin Uni is active learning. This approach engages students to be active in the learning process with methods that are more than, not without, the traditional base of lectures and tutorials. The instructor or

teacher plays the role of facilitator and provides the environment where students responsibly and actively acquire as much as possible, rather than are passively given, the learning points that the course desires.

Participants in this course will learn and share through a mix of lectures, tutorials, non-judgmental journal writing, presentations, and learning to collaborate with others through group projects. The learning environment should be safe, frank, friendly, collaborative, and enlightening.

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

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

2 credits

Pre-requisites: None

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

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

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

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

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

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

2 credits

Pre-requisites: None

The great American humorist and writer Mark Twain once said, "History doesn't repeat itself, but it often rhymes." This course takes as its point of departure the

possibility of using those rhymes of the past to better help us navigate our present and future. What lessons can we draw? As future businesspeople, health care professionals, engineers, and computer scientists, these lessons have far more relevance than you may imagine.

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

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

ARTS1010: Arts Appreciation

1 credit

Pre-requisites: None

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

opportunities to explore the diversity and richness of what Vietnam has to offer in terms of the arts.

This course offers students opportunities to learn about how art is created and how it evolves over time; it would cultivate and enrich students' artistic senses, experience, and enjoyment of different forms of arts even if the student is not an artist or does not have an ability to draw/paint. In addition, this course fosters and supports students' development of oral and written presentation and communication, critical and analytical thinking, and multicultural perspectives.

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

MUSI1010- Music Appreciation

1 credit

Pre-requisites: None

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

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

This course does not require students to have any prerequisite experience in musical theory or performance; i.e. students are not required to be able to sight-read sheet music, or play any musical instrument. Rather, it helps students become an active and intellectual music listener, as well as it helps students to think further on how music

can be integrated and applied in the daily lives and their own fields of interest. This course is delivered in class and outside class environment if appropriate.

VCOR1010A/B: First Year Experience – OASIS

3 credits

Pre-requisites: None

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

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

LAW3010 Introduction to Law

2 credits

Pre-requisites: None

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

MATH1010 Calculus I

4 credits

Pre-requisites: 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

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.

Course Description:

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.