

BẢNG MÔ TẢ TÓM TẮT MÔN HỌC CHƯƠNG TRÌNH TIỀN TIẾN

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
CS161	Introduction to Computer Science I	Nhập môn Tin học I	- This course is designed to introduce students to problem solving by programming in C++. Programming fundamentals include program structure, assignment, data types, repetition, input/output, flow of control, and functions. Program design development and testing is emphasized.	<ul style="list-style-type: none"> - Practice problem solving by programming in C++. - Comprehend programming fundamentals (include program structure, assignment, data types, repetition, input/output, flow of control, and functions) - Practice solving problem in C++. - Apply program design development and testing. 	4	None
CS162	Introduction to Computer Science II	Nhập môn Tin học II	- The course is the continuation of the Introduction to Computer Science I (CS161). It is designed to teach students arrays, pointers, linked list, file handling and an introduction to object-oriented programming.	<ul style="list-style-type: none"> - Comprehend advanced data types and concepts in programming with arrays, pointers, linked list, file handling - Practice advanced object-oriented programming. 	4	CS161
CS163	Data Structures	Cấu trúc dữ liệu	- The course is designed to teach students popular data structures used in computer programming, including linked-list,	<ul style="list-style-type: none"> - Use some popular data structures in programming, including 	4	CS162

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			stacks, queues, trees. It also provides students knowledge on basic algorithms, such as sorting, searching, recursion and hashing. The course will focus on the implementation of various algorithms and data structures.	<p>linked-list, stacks, queues, trees.</p> <ul style="list-style-type: none"> - Comprehend basic algorithms, such as sorting, searching, recursion and hashing. - Implement various algorithms and data structures. 		
CS201	Computer Systems Programming	Lập trình hệ thống	- Introduction to computer systems from a software perspective. Topics include: Basic machine organization. System programming using C and assembly language. Introduction to system programming tools (gcc, makefile, gdb). Data representation (bits & bytes, characters, integers, floating point numbers, Implementation of control flow, procedure class, and complex data types at machine level. Linking and loading. Exceptions and interrupts. Process control and signals. System calls, File I/O. Timing and improving program performance. Introduction to memory hierarchy, dynamic memory allocation techniques.	<ul style="list-style-type: none"> - Comprehend computer systems from a software perspective. - Practice systems programming using C and assembly language. - Show the understanding on: basic computer organization, presentation of data, machine instruction sets and assembly programming, - Show the relationship between C code and assembly code, C pointers and structures and their machine-level representation. 	4	CS161, CS162

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				<ul style="list-style-type: none"> - Practice linking and loading, debugging program - Implementing of control flow, procedure class, and complex data types at machine level. - Processing control and signals, system calls, file I/O. Timing and improving program performance. - Show the understanding on memory hierarchy, dynamic memory allocation techniques. 		
CS202	Programming Systems	Các hệ thống lập trình	<p>- The course is designed to introduce to students the concepts of object-oriented programming while learning advanced C++ syntax. Students will understand the difference between procedural programming and object oriented programming. Students will learn and practice how to design and program with inheritance hierarchies, with the goal of solving problems efficiently: producing high quality, robust, maintainable as well as efficient object oriented solutions.</p>	<ul style="list-style-type: none"> - Comprehend the concepts of object-oriented programming while learning advanced C++ syntax. - Understand the difference between procedural programming and object oriented programming. - Learn and practice how to design and program with inheritance hierarchies, with the goal 	4	None

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			Students will learn about C++'s classes, objects, function overloading, operator overloading, constructors, destructor, and be introduced to inheritance and polymorphism.	<p>of solving problems efficiently: producing high quality, robust, maintainable as well as efficient object oriented solutions.</p> <ul style="list-style-type: none"> - Learn and practice C++'s classes, objects, function overloading, operator overloading, constructors, destructor - Comprehend and practice inheritance and polymorphism. 		
CS250	Discrete Structures I	Cấu trúc rời rạc I	This course introduces <i>Discrete Mathematics</i> with minimal formal logic. There will be 40 lecture hours and 10 lab sessions in 10 weeks. The course will essentially cover chapters 1-5 and a little of chapters 6, 7, 10 of the textbook. A detailed list of topics is at the end of this syllabus.	<ul style="list-style-type: none"> - Comprehend differential and integral calculus of one variable - Comprehend the concepts and their applications in different settings. 	4	None
CS251	Logical Structures	Cấu trúc logic	The course is the second term of the two term sequence CS 250-251. The main goal of the sequence is that students obtain those skills in discrete	<ul style="list-style-type: none"> - Obtain skills in discrete mathematics and logic that are used in the study and practice of computer science. - Show the understanding on concepts of logic (propositional calculus, 	4	CS250

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			<p>mathematics and logic that are used in the study and practice of computer science. A second goal is that students become familiar with symbolic algebra and logic programming as tools for doing laboratory experiments in discrete mathematics and logic. Logic: propositional calculus, first-order predicate calculus. Formal reasoning: natural deduction, resolution. Applications to program correctness and automatic reasoning. Introduction to algebraic structures in computing. Logic programming is introduced and used for programming experiments.</p>	<p>first-order predicate calculus), formal reasoning (natural deduction, resolution), algebraic structures in computing.</p> <ul style="list-style-type: none"> - Familiar with symbolic algebra. - Use logic programming as tools for doing laboratory experiments in discrete mathematics and logic. 		
CS300	Elements of Software Engineering	Nhập môn Công nghệ phần mềm	Practical techniques of program development for medium-scale software produced by individuals.	<ul style="list-style-type: none"> - Show the understanding on practical techniques of program development for medium-scale 	4	CS202

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			Software development from problem specification through design, implementation, testing, and maintenance. The fundamental design techniques of step-wise refinement and data abstraction. A software project will be carried through the development cycle. -	software produced by individuals. - Practice the phases of software development from problem specification through design, implementation, testing, and maintenance. - Apply the fundamental design techniques of step-wise refinement and data abstraction. - Practice developing a software project through the development cycle.		
CS305	Social, Ethical, and Legal Issues	Đạo đức khoa học	The advancement of information technology has changed the way we leave, interact, and work. However, it also results in social, ethical, and legal issues that we have to address. This course will introduce students important social and professional issues related to information technology and provide opportunities	- Address the social, ethical, and legal issues related to the advancement of information technology. - Comprehend important social and professional issues related to information technology. - Practice discussing real-world situations where social, ethical, and legal implications are relevant to the information technology profession.	2	None

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			for students to discuss real-world situations where social, ethical, and legal implications are relevant to the information technology profession.			
CS311	Computational Structures	Cấu trúc tính toán	Introduces the foundations of computing: regular languages and finite automata; context-free languages and pushdown automata; Turing machines and equivalent models of computation; computability; introduction to complexity.	<ul style="list-style-type: none"> - Show the understanding on foundations of computing: regular languages and finite automata. - Comprehend the context-free languages and pushdown automata; - Comprehend turing machines and equivalent models of computation; - Show the understanding on computability, and complexity. 	4	CS251
CS320	Principles of Programming Languages	Nguyên lý các ngôn ngữ lập trình	This course introduces the overall construction of compilers using a multiphase translation process. It covers the Front-End phase of compiler including lexical analysis, syntax	<ul style="list-style-type: none"> - Show the understanding on the overall construction of compilers using a multiphase translation process. - Comprehend the Front-End phase of compiler including lexical 	4	CS200, CS201, CS311

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
			analysis and semantic analysis. More specifically, it focuses on theory of scanning and parsing and both handwritten and automated scanner and parser implementation. Compiling is essentially a process of symbolically manipulating program representations described by tree and graph-like data structures. Because of this, the course also introduces tools that facilitate symbolic manipulation and definition of such structures as scanner and parser generators. This course emphasizes teamwork in small groups on a substantial project that will be performed for a real customer. Projects are chosen so as to provide interdisciplinary content with project	<p>analysis, syntax analysis and semantic analysis.</p> <ul style="list-style-type: none"> - Show the understanding on theory of scanning and parsing and both handwritten and automated scanner and parser implementation. - Understand compiling is essentially a process of symbolically manipulating program representations described by tree and graph-like data structures. Practice with the tools that facilitate symbolic manipulation and definition of such structures as scanner and parser generators. 		

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			proposals being solicited from the community at large. Projects that involve students as well as customers from other disciplines are encouraged. Lectures will be directed towards the management of software development projects such as those being carried out by the teams. It is the intent of the course to provide a capstone experience that integrates the material contained in the remainder of the CS curriculum through work on a project that applies this material in another discipline.			
CS333	Introduction to Operating Systems	Nhập môn Hệ điều hành	<ol style="list-style-type: none"> 1. To learn the evolution of Operating systems. 2. To study the operations performed by Operating System as a resource manager. 	<ul style="list-style-type: none"> - To learn the evolution of Operating systems. - To study the operations performed by Operating System as a resource manager. 	4	CS200, CS201, CS311

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			3. To study computer security issues and Operating System tools.	- To study computer security issues and Operating System tools.		
CS350	Algorithms and Complexity	Thuật toán và độ phức tạp	<p>You will often be called upon to "give an algorithm" to solve a certain problem. Your write-up should take the form of a short essay. A topic paragraph should summarize the problem you are solving and what your results are. The body of your essay should provide the following:</p> <ol style="list-style-type: none"> 1. A description of the algorithm in English and, if helpful, pseudocode. 2. At least one worked example or diagram to show more precisely how your algorithm works. 3. A proof (or indication) of the correctness of the algorithm. 	<ul style="list-style-type: none"> - Show the description of the algorithm in pseudocode. Use worked example or diagram to show more precisely how the algorithm works. - Give the proof (or indication) of the correctness of the algorithm. Analyze the running time of the algorithm. 	4	CS311

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			4. An analysis of the running time of the algorithm. -			
CS486	Introduction to Database Systems	Nhập môn các hệ cơ sở dữ liệu	<p>Introduction to fundamental concepts of database management with the relational model. Schema design and refinement, query languages, transaction management, security, database application environments, physical data organization, overview of query processing, physical design tuning.</p> <p>To learn how to design effective database schemas that accurately model real-world information semantics. To learn how to pose complex database queries in SQL as well as theoretical query languages. To understand what is meant by a</p>	<ul style="list-style-type: none"> - Understand fundamental concepts of database management with the relational data model. - Design effective database schema that accurately model real-world information semantics. - Pose complex database queries in SQL as well as theoretical query languages. - Show the understanding on concepts and their applications such as transaction management, concurrency control and recovery, security, database application environments, physical data organization, overview of query optimization, physical design tuning. 	4	CS163, CS250, CS251

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			transaction. To gain an introductory background in concurrency control and recovery. To learn about indexing in database systems. -	- Practice creating index in database systems.		
CS487- CS488	Capstone Project	Đồ án tốt nghiệp	Emphasizes teamwork in small groups on a substantial project that will be performed for a real customer. Projects are chosen so as to provide interdisciplinary content with project proposals being solicited from the community at large. Projects that involve students as well as customers from other disciplines are encouraged. Lectures will be directed towards the management of software development projects such as those being carried out by the teams. It is the intent of the course to provide a capstone experience	<ul style="list-style-type: none"> - Work in small groups on a substantial project that will be performed for a real customer. - Work on the interdisciplinary content projects. Their proposals are solicited from the community at large. - Design the project. - Manage the software development projects. - Contribute to the design, documentation, and testing phases of the project. 	6	CS163, CS250, CS251

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			that integrates the material contained in the remainder of the CS curriculum through work on a project that applies this material in another discipline. Each team member will contribute to the design, documentation, and testing phases of the project.			
CM101	Communication Management	Kỹ năng giao tiếp	This course is designed to improve communication abilities of freshman students in Advanced Program in Computer Science at the University of Science, Vietnam National University HCM - A joint BSCS program between US-VNU and Portland State University. The course is organized into 6 Chapters, each targets one specific skill:	<ul style="list-style-type: none"> - Improve communication abilities of freshman students. - Formulate a communication strategy - Persuade targeted audiences - Give and receive feedbacks - Manage difficult conversations - Listen and take notes - Perform several in-class exercises, assignments, and one teamwork project. 	4	None

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			1. Formulating A Communication Strategy 2. Giving and Receiving Feedbacks 3. Listening and Taking Notes 4. Persuading Targeted Audiences 5. Managing Difficult Conversations 6. Team-working			
ECE341	Computer Hardware	Phần cứng máy tính	This course presents an overview of computer architecture and programming from a hardware viewpoint. Topics covered in the class include: digital logic gates, multiplexers, flip-flops, state machines; computer arithmetic operations; basic computer architecture - data path, control, and buses; pipelining- HW and CISC vs. RISC; memory hierarchy and virtual memory;	<ul style="list-style-type: none"> - Show the understanding on computer architecture and programming from a hardware viewpoint. - Show the understanding on the computer hardware concepts, which include: digital logic gates, multiplexers, flip-flops, state machines, computer arithmetic operations, basic computer architecture - data path, control, and buses, pipelining- HW and CISC vs. RISC; 	4	None

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			input/output techniques - polling, interrupt, DMA; hardware view of computer system components - keyboard, mouse, displays, printers, disks, modems, and LANs.	<ul style="list-style-type: none"> - Comprehend memory hierarchy and virtual memory; - Explain input/output techniques - polling, interrupt, DMA; - Give hardware view of computer system components - keyboard, mouse, displays, printers, disks, modems, and LANs. 		
SC203	Scientific Method	Phương pháp khoa học	<p>To define an experimental project, invest on your capability to observe, develop a hypothesis, state project objective(s) and success criteria.</p> <p>Through lectures and practical in-class exercises aiming at developing scientific aptitudes, students are exposed to relevant methods, processes and techniques for: Reading and Analyzing scientific articles, Raising a Hypothesis that reflects a Question to</p>	<ul style="list-style-type: none"> - Define an experimental project, invest on your capability to observe, develop a hypothesis, state project objective(s) and success criteria. - Aim at developing scientific aptitudes - Comprehend the methods, processes and techniques for: reading and analyzing scientific articles, - Raise a hypothesis that reflects a question to be answered. - Design the experiments to test the raised 	4	None

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			be answered, Designing the experiments to test the raised hypothesis, Implementing the experimentation, Executing the tests and Analyzing the obtained data, Documenting the obtained results.	hypothesis, Implement the experimentation - Execute the tests and analyze the obtained data Document the obtained results		
WR227	Technical Writing	Kỹ năng viết tài liệu khoa học	To define an experimental project, invest on your capability to observe, develop a hypothesis, state project objective(s) and success criteria. Through readings, discussions and practical exercises, we will focus on basic principles of good writing and on organizational matters aiming at developing skills that enable you to produce clear and effective scientific and technical documents.	<ul style="list-style-type: none"> - Define an experimental project, invest on your capability to observe, develop a hypothesis, state project objective(s) and success criteria. - Practice reading, discussing and doing practical exercises. - Comprehend basic principles of good writing and on organizational matters aiming at developing skills to produce clear and effective scientific and technical documents. 	4	SC203

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MTH2 51	Calculus I	Vi tích phân I	To equip the students with the concept and techniques of limit, differentiation and their applications; as well as the theory and techniques of integration: Function and Models, Limits and Derivatives, Differentiation Rules, Application of Differentiation, Integrals, Techniques of Integration	<ul style="list-style-type: none"> - Show the understanding on concepts and techniques of limit, differentiation and their applications; - Comprehend the theory and techniques of integration: function and models, limits and derivatives, differentiation rules, application of differentiation, integrals, technique of integration. 	4	None
MTH2 52	Calculus II	Vi tích phân II	This course covers topics in integrations, differential equations, parametric curves, sequences, numerical and functional series.	<ul style="list-style-type: none"> - Show the understanding on advanced topics of integrations, differential equations, parametric curves, sequences, numerical and functional series. - Do the exercises relevant to these above topics. 	4	<i>MATH2 51</i>
MTH2 53	Calculus III	Vi tích phân III	To equip the students with the concept and techniques of vector valued functions and functions of several variables, partial differentiation; the	<ul style="list-style-type: none"> - Comprehend the concept and techniques of vector valued functions and functions of several variables, partial differentiation; 	4	<i>MATH2 52</i>

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			theory of multiple integrals and an introduction to vector calculus.	<ul style="list-style-type: none"> - Show the understanding on the theory of multiple integrals. - Show the understanding on vector calculus. 		
STAT451	Applied Statistics for Engineers and Scientists	Xác suất thống kê	<p>Randomness and uncertainty are phenomena that CS, finance and engineering students are facing in both their daily life and in professional environments. The course' aims are to provide to students in Computing, Business Administration, Econometrics and Biological Sciences fundamental methodologies together with major formalizations and techniques of Probability theory and Statistics, in particular Descriptive Statistics and Basic Inferential Statistics.</p> <p>-</p>	<ul style="list-style-type: none"> - Recognize that randomness and uncertainty are phenomena that CS, finance and engineering students are facing in both their daily life and in professional environments. - Show the understanding on Computing, Business Administration, Econometrics and Biological Sciences fundamental methodologies - Address major formalizations and techniques of Probability theory and Statistics, in particular Descriptive Statistics and Basic Inferential Statistics. 	4	CS250, CS251

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PH214	Physics Laboratory I	Thực hành Vật lý I	The students be master of general idea, the error. To know different between density and private mass. Viscosity of liquids, the viscosity is dependence of different temperature. Reversible pendulum and Mathematical pendulum. The Malus' law, polarization of light, to measure concentration of sugar. The Lambert-Beers' law, absorption of light. Refraction of light, dispersion and resolving power of the prisms (flint glass, crown glass). Heat for ice, heat capacity of metals, volt meter and ampe.	<ul style="list-style-type: none"> - Know different between density and private mass. - Show the understanding on viscosity of liquids, reversible pendulum and mathematical pendulum. 	1	None
PH215	Physics Laboratory II	Thực hành Vật lý II	The students be master of general idea, the error. To know different between density and private mass. Viscosity of	<ul style="list-style-type: none"> - Comprehend the Malus' law, polarization of light, the Lambert-Beers' law, the absorption of light. - Measure concentration of sugar. 	01	None

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			liquids, the viscosity is dependence of different temperature. Reversible pendulum and Mathematical pendulum. The Malus' law, polarization of light, to measure concentration of sugar. The Lambert-Beers' law, absorption of light. Refraction of light, dispersion and resolving power of the prisms (flint glass, crown glass). Heat for ice, heat capacity of metals, volt meter and ampe.			
PH216	Physics Laboratory III	Thực hành Vật lý III	The students be master of general idea, the error. To know different between density and private mass. Viscosity of liquids, the viscosity is dependence of different temperature. Reversible pendulum and Mathematical	<ul style="list-style-type: none"> - Show the understanding on refraction of light, dispersion and resolving power of the prisms (flint glass, crown glass). - Recognize heat for ice, heat capacity of metals, volt meter and ampe. 	01	None

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			pendulum. The Malus' law, polarization of light, to measure concentration of sugar. The Lambert-Beers'law, absorption of light. Refraction of light, dispersion and resolving power of the prisms (flint glass,crown glass). Heat for ice, heat capacity of metals, volt meter and ampe.			
PH221	General Physics I	Vật lý Đại cương I	Physics and mechanics, One dimensional kinematics, Vectors and trigonometry, Two dimensional kinematics, Newton's laws of motion, Applications of Newton's laws, Energy, Work and kinetic energy, Potential energy and conservative forces, Linear momentum and collisions, Rotational motion,	<ul style="list-style-type: none"> - Show understanding on concepts such as physics and mechanics, one dimensional kinematics, vectors and trigonometry, two dimensional kinematics, Newton's laws of motion. - Apply Newton's laws, - Comprehend the concepts of energy, work and kinetic energy, potential energy and conservative forces, 	3	None

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			Rotational dynamics and static equilibrium, Oscillations about equilibrium, Waves and Sound, Fluids, Temperature and heat, Ideal gas law	Linear momentum and collisions, Rotational motion, Rotational dynamics and static equilibrium, Oscillations about equilibrium, Waves and Sound, Fluids, Temperature and heat, Ideal gas law		
PH222	General Physics II	Vật lý Đại cương II	Electric charge. electric fields, electric energy and capacitance, current and resistance. direct current circuits, magnetism, electromagnetic induction, alternating-current circuits, electromagnetic waves.	<ul style="list-style-type: none"> - Show the understanding on electric charge, electric fields, electric energy and capacitance, current and resistance. direct current circuits, magnetism, electromagnetic induction, alternating-current circuits, electromagnetic waves. - Use the above concepts to solve exercises 	3	None
PH223	General Physics III	Vật lý Đại cương III	Oscillations, Mechanical Waves-I, Maxwell's Equations, Electromagnetic Waves, Interferences, Diffraction.	<ul style="list-style-type: none"> - Show the understanding on Oscillations, Mechanical Waves-I, Maxwell's Equations, Electromagnetic Waves, Interferences, Diffraction. 	3	None

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				<ul style="list-style-type: none"> - Use the above concepts to solve exercises 		
CS411	Computer Graphics	Đồ họa máy tính	<p>This class will introduce about concepts, structures, and programming techniques for display of 2D and 3D objects. It will include drawing algorithms (line, circle), rasterization (triangle and polygon), 2D geometrical transformation, 3D geometrical transformations, 3D projections (orthographic and perspective), surface shading, 2D and 3D clipping, and ray tracing. OpenGL will be the main toolbox for experiments.</p>	<ul style="list-style-type: none"> - Show the understanding on concepts, structures, and programming techniques for display of 2D and 3D objects. - Apply the techniques on drawing algorithms (line, circle), rasterization (triangle and polygon), 2D geometrical transformation, 3D geometrical transformations, 3D projections (orthographic and perspective), surface shading, 2D and 3D clipping, and ray tracing. - Use OpenGL as the main toolbox for experiments. 	4	CS202, MTH261
CS412	Computer Vision	Thị giác máy tính	<p>Computer vision course will provide knowledge about how to define and detect the features of image and video. Some basic problems of computer vision will be explained in this course</p>	<ul style="list-style-type: none"> - Comprehend the knowledge about how to define and detect the features of image and video. - Explain some basic problems of computer vision such as image 	4	None

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			such as image segmentation, object detection, object tracking, object recognition, stereo matching, etc. This course will also provide a skill of computer programming using OpenCV through project final.	segmentation, object detection, object tracking, object recognition, stereo matching, etc. Apply the skill of computer programming using OpenCV through project final.		
CS417	Game Theory, Multi-Agents and Social Algorithms	Lý thuyết game - Hệ thống đa tác nhân và thuật toán xã hội	There has been an explosive growth of online communities in recent years. These communities involve millions of users and span a wide range of media and platforms from instant messaging, to blogging and social networking. This leads to complex and intricate interactions between users in these communities. The course aims at giving you an introduction to some of the fields that might shed light on how certain behaviors or phenomena arise in	<ul style="list-style-type: none"> - Aim at introduction to some of the fields that might shed light on how certain behaviors or phenomena arise in these highly connected systems. - Comprehend the topics in game theory, multi-agent systems, and social algorithms with sufficient depth to tackle challenging technical problems. - Find an area that piques the interest to further pursue. 	4	None

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
			these highly connected systems. Specifically, we will cover various topics in game theory, multi-agent systems, and social algorithms with sufficient depth to tackle challenging technical problems. However the main goal is for you to find an area that piques your interest to further pursue it.			
CS418	Introduction to Natural Language Processing	Nhập môn xử lý ngôn ngữ tự nhiên	Natural language processing (NLP) deals with computational methods to convert text or speech data (unstructured data) into structured data. NLP is considered a branch of artificial intelligence. Typical applications of NLP are: text classification, text summarization, machine translation, information retrieval, question answering. This course introduces	<ul style="list-style-type: none"> - Aim at computational methods to convert text or speech data (unstructured data) into structured data. - Comprehend some typical applications of NLP: text classification, text summarization, machine translation, information retrieval, question answering. - Explain some basic concepts and techniques for processing text. 	4	CS162

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
			basic concepts and techniques for processing text, and two NLP applications: spelling-error correction and text classification.	<ul style="list-style-type: none"> - Use two NLP applications: spelling-error correction and text classification. 		
CS419	Introduction to Information Retrieval	Nhập môn tìm kiếm thông tin	The course introduces fundamental theory, design and implementation techniques for information retrieval system. The core components of the course includes: organization, representation and access to information; indexing and indexes; query and retrieval models; categorization and clustering algorithms; link analysis; relevance feedback and query expansion. Textual and visual information retrieval systems are under investigation.	<ul style="list-style-type: none"> - Aim at fundamental theory, design and implementation techniques for information retrieval system. - Comprehend the core components of the course includes: organization, representation and access to information; indexing and indexes; query and retrieval models; categorization and clustering algorithms; link analysis; relevance feedback and query expansion. - Investigate textual and visual information retrieval systems. 	4	CS163, STAT45 1, MATH2 61

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
CS420	Artificial Intelligence	Trí tuệ nhân tạo	Introduction to the basic concepts and techniques of artificial intelligence. Knowledge representation, problem solving, and AI search techniques. Program will be written in one of the AI languages.	<ul style="list-style-type: none"> - Show the understanding on basic concepts and techniques on artificial intelligence. - Comprehend knowledge representations, solving problem techniques using AI. - Conduct experimental programs using AI techniques. 	4	CS202, CS311
CS421	Software Requirement	Quản lý yêu cầu phần mềm	This course introduces the methods and techniques that support collecting, identifying, analyzing, specifying, testing, and managing (software) requirements. The content of this course focuses on introducing and guiding students to implement the process of analyzing and managing requirements with a specific methodology (currently RUP).	<ul style="list-style-type: none"> - Comprehend the methods and techniques that support collecting, identifying, analyzing, specifying, testing, and managing (software) requirements. - Implement the process of analyzing and managing requirements with a specific methodology (currently RUP). 	4	None

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
CS422	Software Analysis and Design	Phân tích và thiết kế phần mềm	<p>This course introduces the common principles to analyze and design software from software requirements.</p> <p>The content of this course focuses on object oriented techniques (using UML) to analyze, to design architecture, interface, business logic, and data.</p> <p>Several advanced topics can be optionally introduced (e.g. design patterns, service oriented architecture...)</p>	<ul style="list-style-type: none"> - Show the understanding on the common principles to analyze and design software from software requirements. - Use object oriented techniques (using UML) to analyze, to design architecture, interface, business logic, and data. - Comprehend several advanced topics such as design patterns, service oriented architecture... 	4	None
CS423	Software Testing	Kiểm chứng phần mềm	<p>This course introduces the methods and techniques in the field of Quality, Assurance (QA) and Quality Control (QC). After finish this course, students can use basic techniques, to design the test cases, test plan and use the open</p>	<ul style="list-style-type: none"> - Show the understanding on the methods and techniques in the field of Quality, Assurance (QA) and Quality Control (QC). - Use basic techniques for designing the test cases, test plan and using the 	4	None

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
			source tools to test the software. Besides that, student can organize and manage the software testing project, deploy the bug tracking system...	open source tools to test the software. - Organize and manage the software testing project, deploy the bug tracking system...		
CS424	Web Application Development	Phát triển ứng dụng Web	This course introduces the methods and techniques in the field of Quality, Assurance (QA) and Quality Control (QC). After finish this course, students can use basic techniques, to design the test cases, test plan and use the open source tools to test the software. Besides that, student can organize and manage the software testing project, deploy the bug tracking system...	<ul style="list-style-type: none"> - Show the knowledge and techniques in developing web applications. - Show the understanding on the web and internet overview, client-server model of the web applications as well as the detail steps in building a website. - Use the client-side and server-side technologies in developing web applications, - Use the issues of and solutions to web security - Use the basic techniques and the tools in testing the web applications. 	4	None
CS426	Mobile Device Application Development	Phát triển ứng dụng trên thiết bị di động	The content of this course includes basic to advanced topics in application	<ul style="list-style-type: none"> - Show the understanding on basic to advanced topics in application 	4	None

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
			<p>development for Android mobile devices:</p> <ul style="list-style-type: none"> • Developing application with widgets, events, and intent. • Using maps, direction, and localization for location-based applications • File, storage, and database • Graphics, animation, customized and advanced UI. • Using Web APIs (Facebook, Dropbox, customized web services) • Sensors, network programming and short-range communication 	<p>development for Android mobile devices.</p> <ul style="list-style-type: none"> - Develop application with widgets, events, and intent. - Use maps, direction, and localization for location-based applications - Use the concepts and techniques such as file, storage, and database, graphics, animation, customized and advanced UI. - Use Web APIs (Facebook, Dropbox, customized web services). - Practice sensors, network programming and short-range communication - Practice monetization, in-app purchasing, and publishing applications to store. 		

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
			<ul style="list-style-type: none"> Monetization, in-app purchase, and publishing applications to store. 			
CS427	3D Visualization and Game Development	Trực quan hóa 3D và phát triển Game	The content of this course includes architecture and main components of a game and game-related applications, such as generate and render 3D scenes, create visual environmental effects with vertex shaders and pixel shaders. This course also provides students with basic to advanced techniques in data visualization of multivariate and high dimensional data.	<ul style="list-style-type: none"> Show the understanding on architecture and main components of a game and game-related applications, such as generate and render 3D scenes, create visual environmental effects with vertex shaders and pixel shaders. Apply basic to advanced techniques in data visualization of multivariate and high dimensional data. 	4	None
CS428	Electronic Commerce	Thương mại điện tử	The course briefly looks at topics such as fundamentals of EC, online business models, EC infrastructures and softwares, electronic payments,	<ul style="list-style-type: none"> Show the understanding on topics such as fundamentals of EC, online business models, EC infrastructures and software, electronic payments, internet 	4	None

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
			internet marketing and advertising strategies, and web technologies	marketing and advertising strategies, and web technologies - Conduct an experimental application.		
CS429	Mining on Big Data	Khai thác trên dữ liệu lớn	The course will discuss data mining and machine learning algorithms for analyzing very large amounts of data. The emphasis will be on Map Reduce as a tool for creating parallel algorithms that can process big data. This course also gives students a practical understanding of the tools in the Hadoop ecosystem with a focus on understanding MapReduce.	- Comprehend the data mining and machine learning algorithms for analyzing very large amounts of data. Show the understanding on Map Reduce, a tool for creating parallel algorithms that can process big data. - Show the practical understanding of the tools in the Hadoop ecosystem with a focus on understanding MapReduce. - Using the tools for experimental results.	4	None
CS430	Human-Computer Interaction	Tương tác người - máy	Introduction to the basic theory of human-computer interaction. Principles of human cognition and interface design, interface evaluation	- Show the basic understanding on human-computer interaction. - Comprehend the principles of human recognition.	4	CS202

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
			techniques. Several prototyping tools will be presented. A project is required.	<ul style="list-style-type: none"> - Design the user interface and its refinement. - Apply the tools for designing human-computer interaction. 		
CS431	Wireless Network	Mạng không dây	Wireless networks and the use of wireless networks in industry environments. Topics include reasons why current technology of wired networked cannot be directly apply for wireless environments; key issues affects the design and implementation of wireless network hardware and software; different models (infrastructure vs. adhoc) and technologies in wireless network (802.11, Wifi, Bluetooth, cellular phones, satellite phones, sensor); different protocols in wireless networks; programming with different	<ul style="list-style-type: none"> - Comprehend the wireless networks and the use of wireless networks in industry environments. - Comprehend the key issues affects the design and implementation of wireless network hardware and software; - Recognize different models (infrastructure vs. adhoc) and technologies in wireless network (802.11, Wifi, Bluetooth, cellular phones, satellite phones, sensor); - Recognize different protocols in wireless networks; - Program with different wireless networks (Bluetooth, 802.11, J2ME); mobile devices (smart phone, laptops). 	4	None

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
			wireless networks (Bluetooth, 802.11, J2ME); programming with mobile devices (smart phone, laptops), securities in wireless networks; routing in wireless networks; location aided in wireless network. May cover some advanced topic: programming with robots for wireless networks.	<ul style="list-style-type: none"> - Arm the security issues in wireless networks; routing in wireless networks; location aided in wireless network. - Comprehend an advanced topic: programming with robots for wireless networks. 		
CS494	Internetworking Protocols	Các giao thức liên mạng	<p>Write and develop network applications: TCP/IP, UDP, client-server, peer-to-peer (Java and C++)</p> <ul style="list-style-type: none"> • Be familiar with socket programming • Acquire an understanding of computer network and its changing character 	<ul style="list-style-type: none"> - Develop network applications: TCP/IP, UDP, client-server, peer-to-peer (Java and C++) - Familiar with socket programming Show the understanding on computer network and its changing character - Understand how computer network is conceptualized and carried out 	4	None

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
			<ul style="list-style-type: none"> • Understand how computer network is conceptualized and carried out • Examine the historical evolution of computer network • Appreciate the usefulness of network applications and protocols 	<ul style="list-style-type: none"> - Examine the historical evolution of computer network - Appreciate the usefulness of network applications and protocols 		
MTH261	Introduction to Linear Algebra	Đại số tuyến tính	To give an elementary treatment of Linear Algebra and its applications, namely in systems of linear equations, matrices and determinants, vector spaces and linear transformations. An introductory treatment of inner products and eigenvalues, eigenvectors is also consider: systems of linear equations and matrices, determinants, vectors in 2-space and 3-space,	<ul style="list-style-type: none"> - Give an elementary treatment of Linear Algebra and its applications, namely in systems of linear equations, matrices and determinants, vector spaces and linear transformations. - Comprehend an introductory treatment of inner products and eigenvalues, eigenvectors is also consider: systems of linear equations and 	4	None

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
			euclidean vector spaces, general vector spaces, inner product spaces, eigenvalues, eigenvectors	matrices, determinants, vectors in 2-space and 3-space, euclidean vector spaces, general vector spaces, inner product spaces, eigenvalues, eigenvectors		
MTH344	Group Theory	Lý thuyết nhóm	The course aims to provide students with basic notions of group theory and its applications. After giving the basic definitions for groups, we introduce fundamental properties of groups: homomorphisms, normal subgroups and factor groups, cyclic groups, permutation groups. Especially, some important applications of groups to number theory, computer science, and other domains will be presented.	<ul style="list-style-type: none"> - Show the understanding on basic notions of group theory and its applications. - Comprehend the fundamental properties of groups: homomorphisms, normal subgroups and factor groups, cyclic groups, permutation groups. - Aim at some important applications of groups to number theory, computer science, and other domains. 	4	CS251
MTH346	Number Theory	Lý thuyết số	The aim of this course is to provide students specialized in computer	<ul style="list-style-type: none"> - Show the understanding on basic knowledge on number theory: divisibility and 	4	MATH251,

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
			science basic knowledge on number theory. We start from basic notions, such as divisibility and primality, congruences and finish with some practical problems of algorithmic number theory: finding generators and discrete logarithms in \mathbb{Z}_p^* , computing squares roots, primality tests. The theory will be provided in algebraic form with an emphasis on algorithms and applications.	primality, congruences and finish with some practical problems of algorithmic number theory: finding generators and discrete logarithms in \mathbb{Z}_p^* , computing squares roots, primality tests. - Comprehend algorithms and applications in algebraic form.		<i>CS161, CS162, CS163, CS350</i>
STAT452	Applied Statistics for Engineers and Scientists 2	Thống kê máy tính và ứng dụng	This class will introduce about the concepts and models of statistics for dealing with the meanings and variability in observed data. In details, this class will provide background knowledge of statistical analysis in terms of simple and multiple linear	- Show the understanding on concepts and models of statistics for dealing with the meanings and variability in observed data. - Show the background knowledge of statistical analysis in terms of simple and multiple linear regressions,	4	<i>STAT451</i>

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
			regressions, analysis of variance (one-way ANOVA for completely randomized design, one-way ANOVA for randomized block design ANOVA), moving average, autoregressive model, and point estimations of parameters in the first 5 weeks.	analysis of variance (one-way ANOVA for completely randomized design, one-way ANOVA for randomized block design ANOVA), moving average, autoregressive model. - Do the exercises using the provided models and techniques		
CS404	Internship	Thực tập thực tế		<ul style="list-style-type: none"> - Know and experience the real working context at a Computer Science company or professional organization as full-time interns. - Take part in the company's real projects. - Discover organization structures, roles and responsibilities within that structure, the processes applied at the company; 	4	None

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				<ul style="list-style-type: none"> - Demonstrate their own knowledge, techniques and professional skills; - Comprehend the company culture or etiquette rules. Make more connections with people in the same professional field. - Gain insight into a career path for their future job. - Build their professional manners and attitude to adapt in the business and industrial environment. 		
CS405	Open Economy, Entrepreneurship & Education	Kinh tế mở, doanh nhân và giáo dục	Introducing different mechanisms of OpEEE (e.g. sharing economy, collaborative models, open source, Do It Yourself / Makers approaches, open science & research, empowering innovations) & practical tools to efficiently conduct projects. A strong emphasis will be put on digital tools and networking skills during all the	<ul style="list-style-type: none"> - Show the understanding on different mechanisms of OpEEE (e.g. sharing economy, collaborative models, open source, Do It Yourself / Makers approaches, open science & research, empowering innovations) - Use practical tools to efficiently conduct projects. - Use digital tools and networking skills during all the class. 	4	None

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
			<p>class. Students will also have a chance to meet with players active in this new economy. Subjects will be co-defined with host companies / organizations. Students, then in group of 3-4 people, will apply the different mechanisms of OpEEE in order to initiate the very first concepts. Interactions with different players (companies, communities of end users, stakeholders) in related ecosystems will be crucial to iterate & validate the final concept. A prototype is highly recommended in order to have a concrete result but it is not obligatory. Daily stand-up will be held in order to ensure coherence & reactivity of all activities.</p>	<ul style="list-style-type: none"> - Have a chance to meet with players active in this new economy. - Apply (in group of 3-4 people) the different mechanisms of OpEEE in order to initiate the very first concepts (subjects are co-defined with host companies / organizations). - Interact with different players (companies, communities of end users, stakeholders) in related ecosystems to iterate & validate the final concept. - Conduct a prototype (is highly recommended) in order to have a concrete result 		

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
CS407	Technology-based Innovation and Leadership	Đổi mới công nghệ và khả năng lãnh đạo	Technology-based innovation and business survival, Leadership in technology-based innovation, Strategy formulation and execution.	<ul style="list-style-type: none"> - Show the understanding on technology-based innovation and business survival - Comprehend leadership in technology-based innovation - Aim at strategy formulation and execution. 	4	None
CS408	Computational Finance	Tính toán tài chính	Macroeconomics basics, introduction to stochastic calculus and option pricing, Banking system, Banking regulations, Risk modelling.	<ul style="list-style-type: none"> - Show the understanding on concepts such as macroeconomics basics, introduction to stochastic calculus and option pricing, - Comprehend banking system, banking regulations, Aim at risk modeling 	4	None
CS409	Entrepreneurship	Sáng nghiệp Công nghệ thông tin	This course will help you answer the following questions: what is entrepreneurship, what knowledge, skills, and abilities are important in starting a new venture, how can I	<ul style="list-style-type: none"> - Answer the following questions: what is entrepreneurship, what knowledge, skills, and abilities are important in starting a new venture, - To be able to become a successful IT entrepreneur now or in the future. 	4	None

Mã môn	Tên TA	Tên tiếng Việt	Mô tả môn học	Chuẩn đầu ra của môn học	Số tín chỉ	Điều kiện tiên quyết
			become a successful IT entrepreneur now or in the future.			
KT006	Macro economics	Kinh tế vĩ mô	This course will introduce students to the study of the economy as a whole. Simple models will be developed to better understand the driving forces and welfare consequences of phenomena such as inflation, unemployment, economic growth, foreign debt, and current account deficit. Importantly, the effectiveness and desirability of policymakers' responses to various economic situations via monetary and fiscal policy will be discussed in detail.	<ul style="list-style-type: none"> - Comprehend the economy as a whole. - Address simple models and the development to better understand the driving forces and welfare consequences of phenomena such as inflation, unemployment, economic growth, foreign debt, and current account deficit. - Comprehend that the effectiveness and desirability of policymakers' responses to various economic situations via monetary and fiscal policy. 	4	None