

**VNUHCM-UNIVERSITY OF SCIENCE
FACULTY OF INFORMATION TECHNOLOGY**

COURSE INFORMATION HANDBOOK

(Short-form version)

2023

LIST OF COURSES

CSC00004 - Introduction to Information Technology	1
CSC10001 - Introduction to Programming	2
CSC10002 - Programming Techniques.....	3
CSC10003 - Object-Oriented Programming	4
CSC10004 - Data Structures and Algorithms	5
CSC10006 - Introduction to Databases	6
CSC10007 - Operating Systems.....	7
CSC10008 - Computer Networking	8
CSC10009 - Computer Systems.....	9
CSC13002 - Introduction to Software Engineering	10
CSC14003 - Fundamentals of Artificial Intelligence.....	11
CSC10102 - Career Observation.....	12
CSC10103 - Entrepreneurship in IT.....	13
CSC10104 - Linear Programming.....	14
CSC10105 - Introduction to Algorithmic Thinking.....	15
CSC10106 - Combinatorial Algorithms and Applications	16
CSC10107 - Internship.....	17
CSC10108 - Data Visualization	18
CSC10121 - Personal and Interpersonal Skills	19
CSC11002 - Telecommunication Systems.....	20
CSC11003 - Computer Network Programming	21
CSC11004 - Advanced Computer Networking.....	22
CSC11005 - Computer Network Laboratory	23
CSC11103 - Computer Network Design.....	24
CSC11106 - Wireless Communications.....	25
CSC11107 - Digital Communications.....	26
CSC11111 - Advanced Topics in Computer Networking.....	27
CSC11112 - Advanced Topics in Distributed System	28
CSC11113 - Computer and Network Service Administration	29

CSC11115 - Network Security	30
CSC12001 - Data Security in Information Systems	31
CSC12002 - Advanced Database Systems	32
CSC12003 - Database Management Systems	34
CSC12004 - Information Systems Analysis and Design	35
CSC12005 - Modern Information Systems Development	36
CSC12102 - Special Topics in Information Systems	37
CSC12103 - Advanced Topics in Database Management Systems	38
CSC12105 - Electronic Commerce	39
CSC12106 - Human-Computer Interaction.....	40
CSC12107 - Information Systems for Business Intelligence	41
CSC12108 - Distributed Applications.....	42
CSC12109 - Introduction to Enterprise Information Systems	43
CSC12110 - Applied Data Analytics	44
CSC12111 - Modern Database Management	45
CSC13001 - Windows Programming.....	46
CSC13003 - Software Testing.....	47
CSC13005 - Software Requirements Engineering.....	48
CSC13006 - Software Project Management	49
CSC13007 - Game Development	51
CSC13008 - Web Application Development	52
CSC13009 - Mobile Application Development	53
CSC13010 - Software Design	54
CSC13101 - Advanced Topics in Software Engineering	56
CSC13102 - Java Application Programming	57
CSC13103 - Distributed Systems Development with Java	58
CSC13106 - Software Architecture.....	59
CSC13107 - Object-Oriented Design Patterns and Applications.....	61
CSC13108 - Software Modeling	62
CSC13112 - User Interface Design	64
CSC13114 - Advanced Web Application Development.....	65
CSC13115 - Modern Software Development Technologies	66
CSC13116 - Software Engineering Capstone	67



CSC13117 - Advanced Game Development.....	69
CSC13118 - Advanced Mobile Application Development.....	70
CSC14001 - Automata and Formal Languages.....	71
CSC14002 - Knowledge-Based Systems	72
CSC14004 - Data Mining and Applications	73
CSC14005 - Introduction to Machine Learning.....	74
CSC14006 - Pattern Recognition	75
CSC14007 - Introduction to Algorithm Complexity Analysis.....	76
CSC14008 - Scientific Research Methodology	77
CSC14101 - Data Hiding and Steganography.....	79
CSC14105 - Web Science	80
CSC14109 - Fuzzy Logic and Applications.....	81
CSC14111 - Introduction to Design and Analysis of Algorithms	83
CSC14112 - Biometrics	84
CSC14113 - Compiler.....	85
CSC14118 - Introduction to Big Data.....	86
CSC14114 - Applications of Big Data.....	87
CSC14119 - Introduction to Data Science	88
CSC14115 - Applied Data Science	89
CSC14116 - Applied Parallel Programming.....	90
CSC14117 - Introduction to IoT Programming	91
CSC14120 - Parallel Programming.....	92
CSC15001 - Computer Security.....	93
CSC15002 - Database Security	94
CSC15003 - Applied Cryptography.....	95
CSC15004 - Statistical Learning.....	96
CSC15005 - Introduction to Cryptography.....	97
CSC15006 - Introduction to Natural Language Processing.....	98
CSC15008 - Natural Language Processing and Applications.....	99
CSC15007 - Computer Statistics and Applications	100
CSC15009 - Digital Signal Processing	101
CSC15010 - Blockchain and Applications.....	102
CSC15011 - Introduction to Statistics Linguistics and Applications.....	103



CSC15102 - Social Network Analysis	104
CSC15103 - Quantitative Finance.....	105
CSC15104 - Data Safety and Recovery	106
CSC15105 - Text Mining and Applications.....	107
CSC15106 - Knowledge Engineering Seminars	108
CSC15107 - Privacy-Preserving Data Analysis.....	109
CSC15201 - Capstone Projects in Applied Cryptography and Information Security	110
CSC15202 - Capstone Projects in Computational Linguistics.....	111
CSC16001 - Computer Graphics.....	112
CSC16002 - Mathematical Methods for Visual Information Analysis.....	113
CSC16003 - Multivariate Statistical Analysis	115
CSC16004 - Computer Vision	116
CSC16005 - Digital Image and Video Processing.....	117
CSC16101 - Applied Computer Graphics.....	119
CSC16102 - Programming Techniques in Digital Image and Video Processing	120
CSC16104 - Robot Vision.....	121
CSC16105 - Visual Information Retrieval.....	122
CSC16106 - Introduction to Smart Device Programming	123
CSC16107 - Applications of Computer Vision.....	124
CSC16109 - Applications in Digital Image and Video Processing	125
CSC16110 - Selected Topics in Computer Graphics	126
CSC16111 - Selected Topics in Computer Vision.....	127
CSC16112 - Selected Topics in Image and Video Processing.....	128
CSC17001 - Intelligent Data Analysis	129
CSC17107 - Applications of Intelligent Data Analysis	130
CSC17101 - Recommender Systems	131
CSC17102 - Deep Learning for Data Science.....	132
CSC17103 - Graph Mining	133
CSC17104 - Programming for Data Science	134
CSC17105 - Introduction to Computational Thinking.....	135
CSC17106 - Online Analytical Processing	136
CSC10204 - Capstone Projects	138
CSC10251 - Undergraduate Thesis.....	139



CSC10252 - Industrial-based Thesis	140
MTH00003 - Calculus 1B	141
MTH00081 - Calculus Laboratory 1B	142
MTH00004 - Calculus 2B	143
MTH00082 - Calculus 2B - Practice	144
MTH00030 - Linear Algebra	145
MTH00083 - Linear Algebra - Practice	146
MTH00040 - Applied Statistics for Engineers and Scientists.....	147
MTH00085 - Statistics - Practice	149
MTH00041 - Discrete Mathematics.....	150
MTH00086 - Discrete Mathematics - Practice	151
MTH00050 - Combinatorial Mathematics	152
MTH00051 - Applied Mathematics and Statistics.....	153
MTH00052 - Numerical Analysis.....	154
MTH00053 - Number Theory	155
MTH00054 - Predicate Calculus.....	156
MTH00056 - Mathematics for Artificial Intelligence.....	157
PHY00001 - General Physics 1 (Mechanics - Thermodynamics)	158
PHY00002 - General Physics 2 (Electromagnetic - Optics)	159
PHY00081 - General Physics Laboratory	160
CHE00001 - General Chemistry 1	161
CHE00081 - General Chemistry Laboratory 1	162
CHE00002 - General Chemistry 2	163
CHE00082 - General Chemistry Laboratory 2	164
BIO00001 - Biology 1.....	165
BIO00081 - Biology Laboratory 1	166
BIO00002 - Biology 2.....	167
BIO00082 - Biology Laboratory 2	168
ENV00001 - Environmental Science	169
ENV00003 - Human and Environment.....	170
GEO00002 - Earth Science	171
BAA00003 - Ho Chi Minh's Ideology.....	172
BAA00004 - Introduction to Law	173



BAA00005 - Introduction to Economics	174
BAA00006 - Introduction to Psychology.....	175
BAA00007 - Creativity Methodologies	176
BAA00011 - General English 1	177
BAA00012 - General English 2	178
BAA00013 - Academic English 1	179
BAA00014 - Academic English 2.....	180
BAA00021 - Physical Education I.....	181
BAA00022 - Physical Education II.....	182
BAA00101 - Marxist-Leninist Philosophy	183
BAA00102 - Marxist-Leninist Political Economics	184
BAA00103 - Scientific Socialism	185
BAA00104 - History of Vietnamese Communist Party.....	186
CSC00006 - Introduction to Artificial Intelligence.....	187
CSC18001 - Introduction to Deep Learning	188
CSC18101 - Artificial Intelligence for Information Security	189
CSC18102 - Mathematics for Optimization.....	190
CSC18103 - Swarm Intelligence.....	191
CSC18104 - Introduction to MultiAgent Systems	192
CSC18105 - Artificial Intelligence Applications	193
CSC10010 - Introduction to Programming for Artificial Intelligence	194
CSC10011 - Software Engineering for Artificial Intelligence.....	195

CSC00004 - Introduction to Information Technology

GENERAL INFORMATION

Course ID:	CSC00004
Course name (English):	Introduction to Information Technology
Course name (Vietnamese):	Nhập môn công nghệ thông tin
Relation to curriculum:	General Education (compulsory)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course gives students an overview of the history of the development and formation of Information Technology (IT). In addition, general knowledge, including basic knowledge of counting systems, computer architecture, operating systems, computer networks, and computer safety, are lectured. Students grasp the roles of software development database systems. Some trends that are becoming popular such as artificial intelligence, natural language processing, image processing, etc., are introduced. The course also helps students orient their study and career orientation by introducing majors and careers. Furthermore, the course equips students with the skills (such as teamwork, critical thinking, and creative thinking) and professional ethics necessary to work and communicate in the learning environment and the company later.

COURSE GOALS

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

1. Implement and present some topics related to general knowledge career orientation in teamwork. Demonstrate critical thinking and creative thinking in the process of implementing topics.
2. Present the meaning, role, status of hardware devices and software. Apply software technology platforms to collaborate, present, share, and backup data.
3. Explain the data storage platform in a computer and describe the roles of database and database administration systems.
4. Identify the role of the operating system, the development process, and distinguish different types of operating systems.
5. Present basic knowledge about computer networks, the internet, network protocols, devices, connection issues, and security issues.
6. Summarize the main characteristics of artificial intelligence and related fields and describe some emerging technologies.
7. List some important rules and regulations in the university environment and in the company environment. Explain some characteristics of professional ethics.

REQUIRED AND RECOMMENDED READING

- [1] Computer science: reflection on the field, reflections from the field, Committee on the Fundamentals of Computer Science, 2004, National Academies Press.
- [2] Computer science: an overview, 12th edition, Gleen Brookshear, Dennis Brylow, 2014.
- [3] Computers are your future, Introductory, 12th Edition, Catherine Laberta, 2011.
- [4] Ethics for the Information Age, 7th Edition, Mike Quinn, 2016.

CSC10001 - Introduction to Programming

GENERAL INFORMATION

Course ID:	CSC10001
Course name (English):	Introduction to Programming
Course name (Vietnamese):	Nhập môn lập trình
Relation to curriculum:	Foundation in concentrations (compulsory)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course is designed to provide students with basic concepts of programming in C syntax. Students will learn how to construct a complete basic C program. Students will also learn how to use C programming structures, such as variables, conditions, loops, and functions. Moreover, students will practice using compound programming structures: struct, array 1-D, 2-D, and File IO, .etc to solve basic problems.

COURSE GOALS

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

1. Describe basic programming concepts.
2. Use basic programming structures.
3. Use compound programming structures.
4. Apply file IO functions to manipulate text files.
5. Write well-organized C programs to solve basic problems.

REQUIRED AND RECOMMENDED READING

- [1] C Programming, A Modern Approach 2nd Edition, K.N.King, 2008, Norton & Company.
- [2] Nhập môn lập trình, Trần Đan Thư, Nguyễn Thanh Phương, Đinh Bá Tiến, Trần Minh Triết, 2011, NXB Khoa học Kỹ thuật.

CSC10002 - Programming Techniques

GENERAL INFORMATION

Course ID:	CSC10002
Course name (English):	Programming Techniques
Course name (Vietnamese):	Kỹ thuật lập trình
Relation to curriculum:	Foundation in concentrations (compulsory)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Programming

COURSE DESCRIPTION

The course is designed to provide students with advanced programming techniques and practices in C/C++ programming language. Students will learn how to use different types of pointers, dynamic memory management, binary file manipulation, etc. Recursion concept and its applications are mentioned in depth. Students will learn how to implement basic data structures such as linked list, stack, and queue. Sort algorithms and problem solving with dynamic programming will also be presented.

COURSE GOALS

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

1. Describe and use advanced programming techniques in C/C++.
2. Define and apply recursion concepts in programming.
3. Describe and implement basic data structures in C/C++.
4. Explain and use sort algorithms and dynamic programming in solving programming problems.
5. Explain and present programming concepts in English.
6. Demonstrate team-work and presentation skills.

REQUIRED AND RECOMMENDED READING

- [1] C Programming: A Modern Approach, 2th Edition, K.N. King, 2008, Norton & Company.
- [2] Kỹ thuật lập trình, Trần Đan Thu, Nguyễn Thanh Phương, Đinh Bá Tiến, Trần Minh Triết, 2011, NXB Khoa Học Kỹ thuật.
- [3] Data Structures and Algorithms in C++, 4th Edition, Adam Drozdek, 2008, Cengage Learning.
- [4] The C Programming Language, 2th Edition, Brian W. Kernighan, Dennis M. Ritchie, 1988, Prentice Hall.
- [5] C Programming, Wikibooks, http://en.wikibooks.org/wiki/C_Programming.

CSC10003 - Object-Oriented Programming

GENERAL INFORMATION

Course ID:	CSC10003
Course name (English):	Object-Oriented Programming
Course name (Vietnamese):	Phương pháp lập trình hướng đối tượng
Relation to curriculum:	Foundation in concentrations (compulsory)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Programming

COURSE DESCRIPTION

The course is designed to provide students the object-oriented concepts, problem analysis, design and solving. The course helps students to differentiate between procedural programming and object-oriented programming. Students are also introduced and instructed with more advanced C++ concepts and features such as class, inheritance, polymorphism, operator overloading, templates, exception handling, and some design patterns. In particular, students could describe key object-oriented concepts, such as encapsulation, data hiding, inheritance and dynamic binding, and are able to solve problems using object-oriented programming. In addition, students are also guided to work in groups on a substantial computer program during the term, providing a user's manual and external design documentation. Students are also gained reading comprehension skills and learn to write simple reports in English.

COURSE GOALS

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

1. Work independently or in groups to solve problems using object-oriented concepts.
2. Perform reading comprehension skills, write and present simple reports in English.
3. Use object-oriented, analysis and design concepts to solve real-world problems.
4. Comprehend the OOP concepts: class, object, data hiding, encapsulation, inheritance, dynamic binding...
5. Describe the key differences between C++, C#, and Java on some OOP topics.
6. Solve problems in C++ using OOP.

REQUIRED AND RECOMMENDED READING

- [1] Lập trình hướng đối tượng, Trần Đan Thu, Đinh Bá Tiến, Nguyễn Tấn Trần Minh Khang, 2018, NXB Khoa học và kỹ thuật.
- [2] C++ Primer Plus, 4th Edition, Stephen Prata, 2001, SAM.
- [3] The C++ Programming Language, 4th edition, Bjarne Stroustrup, 2013, Addison-Wesley Professional.
- [4] Design Patterns: Elements of Reusable Objected-Oriented Software, Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides, 1995, Addison-Wesley.
- [5] Effective Modern C++: 42 Specific Ways to Improve Your Use of C++11 and C++14 1st Edition, Scott Meyers, 2014, O'Reilly Media, Incorporated.

CSC10004 - Data Structures and Algorithms

GENERAL INFORMATION

Course ID:	CSC10004
Course name (English):	Data Structures and Algorithms
Course name (Vietnamese):	Cấu trúc dữ liệu và giải thuật
Relation to curriculum:	Foundation in concentrations (compulsory)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Programming Techniques

COURSE DESCRIPTION

The course is designed to explore the fundamental algorithms and data structures which lay the cornerstone for most studies in computer science. Students will first learn the basic algorithms for search and sorting, reflecting the everyday tasks in practice. Next, students will experience various abstract data structures, including linked lists, hash tables, trees, and graphs, to learn how to implement them in several ways and how the choice affects their efficiencies. Since practical problems are usually resource-limited, it is essential to analyze the strategies in terms of time and space complexities using asymptotic notations, leading to appropriate algorithms and data structures. Students are expected to develop their algorithmic thinking and enhance their programming skills throughout the course.

COURSE GOALS

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

1. Interpret the fundamental concepts and terminologies of Data structures and Algorithms in the given context.
2. Analyze the algorithms and data structures in terms of time and space complexities using asymptotic notations.
3. Choose the algorithms and data structures following the problem requirements (e.g., data size and distribution, a tradeoff between execution time and storage).
4. Implement the algorithms and data structures using C/C++ programming language.
5. Promote personal aptitudes for logical thinking and communication.

REQUIRED AND RECOMMENDED READING

- [1] Data structures and Algorithm Analysis in C (Second Edition), Mark Allen Weiss, 1991, Addison Wesley.
- [2] Introduction to Algorithms, 1990, Thomas H.Cormen, Charles E. Leiserson, Ronald L. Rivest, The MIT Press and McGraw-Hill Book Company.
- [3] Cấu trúc dữ liệu, Dương Anh Đức, Trần Hạnh Nhi, Trường ĐH KHTN – ĐHQG Tp. HCM.
- [4] Cấu trúc dữ liệu & Thuật toán, Đinh Mạnh Tường, 2000, Nhà xuất bản khoa học và kỹ thuật.

CSC10006 - Introduction to Databases

GENERAL INFORMATION

Course ID:	CSC10006
Course name (English):	Introduction to Databases
Course name (Vietnamese):	Cơ sở dữ liệu
Relation to curriculum:	Foundation in concentrations (compulsory)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Data Structures and Algorithms

COURSE DESCRIPTION

The course introduces the overview of the needs of databases in enterprises or organizations. The course provides the study of data models including entity relationship model (or ER model), relational database model and the examination of practical issues such as database design, setup, and manipulation. For database manipulation, the course guides how to use database languages such as relational algebra, relational calculus and structured query language (SQL). The course also provides concepts of functional dependency, normal forms of database schemes as well as the way to normalize a database scheme. Other crucial topics include integrity constraints and the enforcement of all of them. Moreover, the techniques, tools and skills are provided for students to declare and manipulate the database via a relational database management system. The course also mentions future trends in database systems research. The course mentions the way to get the data managed by a selected database management system.

COURSE GOALS

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

1. Apply soft skills to work independently or in groups to solve issues in the database systems.
2. Practice English reading comprehension skills to read textbooks and other documents related to database systems.
3. Explain basic concepts and characteristics of the database and database systems.
4. Apply the Entity-Relationship Model and Relational Data Model for data modeling.
5. Use database languages to manipulate the databases.
6. Discover the quality of a given database scheme and practice the methods to normalize a database scheme.
7. Describe and define integrity constraints in a database.
8. Describe the future trends in database systems research.
9. Set up and manipulate the database using a relational database management system.

REQUIRED AND RECOMMENDED READING

[1] Giáo trình Cơ sở dữ liệu, Đồng Thị Bích Thủy, Phạm Thị Bạch Huệ, Nguyễn Trần Minh Thư, 2010, Nhà xuất bản Khoa học và Kỹ thuật.

CSC10007 - Operating Systems

GENERAL INFORMATION

Course ID:	CSC10007
Course name (English):	Operating Systems
Course name (Vietnamese):	Hệ điều hành
Relation to curriculum:	Foundation in concentrations (compulsory)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Computer Systems

COURSE DESCRIPTION

This course covers the important problems in operating system design and implementation. It will also cover the tradeoffs that can be made between performance and functionality during the design and implementation of an operating system. Particular emphasis will be given to three major OS subsystems: process management (processes, threads, CPU scheduling, synchronization, and deadlock), memory management (segmentation, paging, swapping), and file systems; and on operating system support for distributed systems.

COURSE GOALS

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

1. Explain a lot of practical information about how programming languages, operating systems, and architectures interact and how to use each effectively.
2. Show how the operating system is structured and its components work.
3. Use and manipulate computers and computer program.
4. Use the specialized English terminology in Operating System.
5. Apply some skills at the individual and the teamwork level to present problems in the Computer Networking.

REQUIRED AND RECOMMENDED READING

[1] Giáo trình hệ điều hành, Trần Trung Dũng, Phạm Tuấn Sơn, 2021, NXB Khoa Học Kỹ Thuật.

CSC10008 - Computer Networking

GENERAL INFORMATION

Course ID:	CSC10008
Course name (English):	Computer Networking
Course name (Vietnamese):	Mạng máy tính
Relation to curriculum:	Foundation in concentrations (compulsory)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course objectives include learning about computer network organization and implementation, obtaining a theoretical understanding of data communication and computer networks. This course consists of computer network architectures, protocol layers, network programming, transmission media, encoding systems, switching, network routing, congestion control, flow control, transport protocols, network security.

COURSE GOALS

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

1. Apply some skills at the individual and the teamwork level to present problems in the Computer Networking.
2. Use the specialized English terminology in Computer Networking.
3. Employ and execute at the system level on the number of Computer Networking problems.
4. Identify and operate the basic services of the Computer Networking.
5. Understand and provide solutions to basic network problems. Use basic algorithms learned to solve real problems.
6. Conduct to design, deploy and build a number services of small computer networks.

REQUIRED AND RECOMMENDED READING

- [1] Giáo trình Mạng máy tính, Mai Văn Cường, Trần Trung Dũng, Trần Hồng Ngọc, Lê Ngọc Sơn, Lê Giang Thanh, Trương Thị Mỹ Trang, Đào Anh Tuấn, 2020, NXB Khoa Học Kỹ Thuật.
- [2] Computer Networks, 5th Edition, Andrew S. Tanenbaum ; David Wetherall, 2011, Pearson.

CSC10009 - Computer Systems

GENERAL INFORMATION

Course ID:	CSC10009
Course name (English):	Computer Systems
Course name (Vietnamese):	Hệ thống máy tính
Relation to curriculum:	Foundation in concentrations (compulsory)
Credit points:	2 credits (Theory: 2; Laboratory: 0) / ~ 2 ECTS credits
Prior course(s):	Introduction to Information Technology, Discrete Mathematics

COURSE DESCRIPTION

This course covers computer system hardware organization and the factors influencing the design of hardware and software elements of a computer system, assembly language programming. The programmer interface with the goal of improving students' abilities to reason about the execution of their programs, enhance the performance of their program. After this course, the student should be able to understand what happens inside a computer when it executes a program, how the software and hardware interact.

COURSE GOALS

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

1. Use the specialized English terminology about information technology.
2. Identify basic machine organization, including processors, memory hierarchical, and input/output architecture.
3. Translate bit strings to numbers using unsigned, 2's complement, and IEEE standard floating-point representation system.
4. Apply instruction set architectures: RISC vs CISC, especially MIPS-32bit & x86-32 bit in building an assembly program.
5. Illustrate digital circuit at logic level by simulation tool (combinational circuit).

REQUIRED AND RECOMMENDED READING

- [1] Computer Systems A Programmers Perspective, Prentice.Hall, 2016, Pearson.
- [2] Computer Organization and Design: The Hardware/Software Interface (5th ed), D. A. Patterson and J. L. Hennessy, 2014, Morgan Kaufmann.
- [3] Computer Organization: A Quantitative Approache, Patterson and J. L. Hennessy, 2017, Morgan Kaufmann.
- [4] <https://youtube.com/playlist?list=PLvvXmh2iABsLRCucq8APMG6sh6b-mQ90e>, MBOOK.

CSC13002 - Introduction to Software Engineering

GENERAL INFORMATION

Course ID:	CSC13002
Course name (English):	Introduction to Software Engineering
Course name (Vietnamese):	Nhập môn công nghệ phần mềm
Relation to curriculum:	Foundation in concentrations (compulsory)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Programming Techniques, Introduction to Databases

COURSE DESCRIPTION

The course is designed to provide students the concepts, principles, and practices of software engineering, focusing on software requirements specification, analysis & design, implementation, testing, integration, maintenance, and management. The students will also have opportunities to apply software engineering principles, methods, techniques, and tools by working on multi-person teams to develop and deliver software products.

COURSE GOALS

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

1. Apply personal skills and teamwork skills to present reports based on available templates.
2. Explain software concepts in English.
3. Explain basic concepts, principles, methods, and techniques in software engineering.
4. Classify and compare different software processes.
5. Set up at basic level each phase in software development lifecycle.
6. Construct software artifacts in each phases in software process.
7. Use CASE tools.

REQUIRED AND RECOMMENDED READING

- [1] Software Engineering, 10th Edition, Ian Sommerville, 2017, Pearson India.
- [2] Software Engineering: A Practitioner's Approach, 9th Edition, Roger Pressman, Bruce Maxim, 2019, McGraw-Hill Education.
- [3] Continuous Discovery Habits: Discover Products that Create Customer Value and Business Value, Teresa Torres, 2021, Product Talk LLC.
- [4] Clean Code: A Handbook of Agile Software Craftsmanship, Robert Martin, 2018, Prentice Hall.

CSC14003 - Fundamentals of Artificial Intelligence

GENERAL INFORMATION

Course ID:	CSC14003
Course name (English):	Fundamentals of Artificial Intelligence
Course name (Vietnamese):	Cơ sở trí tuệ nhân tạo
Relation to curriculum:	Foundation in concentrations (compulsory)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Data Structures and Algorithms

COURSE DESCRIPTION

The course is designed to provide students with guides to fundamental problems in AI. Students are introduced to the concept of intelligent agents and how to design problem-solving agents: searching agent, knowledge-based agent, and learning-agent. In the first part, some problems that can be formulated as search problems are introduced. General-purpose search strategies are employed in terms of uninformed search or informed search. Special search problems, such as adversarial search and constraint satisfaction problem, are also introduced. In the second part, students are guided to use propositional logic and first-order logic notions and apply basic inference for solving problems. Finally, basic machine learning concepts as well as conventional approaches are introduced to improve the agent's skills through experiences. During the course, students are asked to improve their problem-solving and programming skills by completing the requirements of assignments and labs.

COURSE GOALS

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

1. Formulate fundamental AI problems using appropriate AI concepts and terminologies.
2. Develop search agents to solve common problem-solving tasks.
3. Develop logical agents whose knowledge is represented using either propositional logic or first-order logic.
4. Develop simple learning agents that learn by observations.
5. Practice generating hypotheses and assess them through theoretical and/or empirical evaluations.
6. Recognize textbook, assignments and practice writing reports in English.
7. Organize tasks while conducting individual and group work.

REQUIRED AND RECOMMENDED READING

- [1] Artificial Intelligence: A Modern Approach, Stuart Russell, Peter Norvig, 2020, Pearson.
- [2] Cơ sở trí tuệ nhân tạo, Lê Hoài Bắc, Tô Hoài Việt, 2014, NXB KH & KT.

CSC10102 - Career Observation

GENERAL INFORMATION

Course ID:	CSC10102
Course name (English):	Career Observation
Course name (Vietnamese):	Kiến tập nghề nghiệp
Relation to curriculum:	Specializations (elective)
Credit points:	2 credits (Theory: 1; Laboratory: 1) / ~ 3 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course aims to provide students with an overview of the Information Technology job market in Vietnam through activities such as company visits and attending career introduction seminars from major IT companies. Additionally, the course provides students with soft skills related to time management, CV writing, and interview skills when applying for jobs. Moreover, this course also provides students with knowledge about new technologies that companies are currently using to help them keep up with industry trends both domestically and globally after graduation.

COURSE GOALS

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

1. Understand the practical working environment and culture of some current IT companies.
2. Apply and coordinate specialized skills, soft skills to grasp and understand issues related to the profession.
3. Analyzing and evaluating one's own career orientation.
4. Students will learn additional soft skills required for the workplace and update their knowledge with new technologies.
5. Understand the issues related to professional responsibility and ethics.

CSC10103 - Entrepreneurship in IT

GENERAL INFORMATION

Course ID:	CSC10103
Course name (English):	Entrepreneurship in IT
Course name (Vietnamese):	Khởi nghiệp
Relation to curriculum:	Specializations (elective)
Credit points:	3 credits (Theory: 2; Laboratory: 1) / ~ 4 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course aims to provide students with knowledge and information about entrepreneurship in the field of Information Technology (IT). Students will learn the steps and processes involved in establishing, organizing, and operating a startup company. Additionally, students will explore methods for developing a business plan based on initial ideas and existing platforms. They will learn how to seek opportunities for company growth, such as funding from investment funds or finding partners for collaborative development. Throughout the course, students will have direct exposure and exchanges with experts who have managed IT startups, allowing them to learn practical experiences in promoting their ideas, products, or services. This course also requires students to form groups and experience the process of building a business from initial basic ideas.

COURSE GOALS

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

1. Establish a working group at an appropriate scale and assign tasks and responsibilities to team members.
2. Explain basic concepts and terminology in both Vietnamese and English related to the field of Entrepreneurship.
3. Write technical reports according to provided templates and present the results in front of audience.
4. Understand the steps involved in the process of building an IT startup.
5. Generate ideas, develop plans, and execute the implementation of a product at a prototype level.

REQUIRED AND RECOMMENDED READING

- [1] Khởi nghiệp tinh gọn, Ries Eric, được dịch bởi, Nguyễn Dương Hiếu, Trịnh Hoàng Kim Phượng, và Đặng Nguyễn Hiếu, 2013, Nhà xuất bản Thời đại, Hà Nội.
- [2] Khởi nghiệp thông minh : Bí quyết tối ưu hóa hệ thống vận hành từ khi khởi nghiệp = Smart Up, Ngô Công Trường, 2016, NXB Đại học kinh tế quốc dân.
- [3] Mô Hình CMMI Một Cách Tiếp Cận Cải Tiến Quy Trình Phần Mềm, Đồng Thị Bích Thủy, Trần Đan Thu, Hoàng Vũ Quỳnh Hà, 2007.
- [4] Kỹ nghệ phần mềm, Tập 1, 2, 3, Roger S. Pressman, Bản dịch của Ngô Trung Việt, 1999.

CSC10104 - Linear Programming

GENERAL INFORMATION

Course ID:	CSC10104
Course name (English):	Linear Programming
Course name (Vietnamese):	Quy hoạch tuyến tính
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course is designed to provide students knowledge related to concepts, knowledge and calculation methods for linear algebra and linear programming problems both in theory and practice aspects.

The course focuses on introducing students to the concepts, some mathematical models, applied problems and simulations in Python to solve problems related to the foundations of linear algebra and linear programming.

COURSE GOALS

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

1. Know some terms in the optimization problems, linear algebra, the basic components such as vectors, matrices, ... Understanding what is the linear programming problem and related concepts.
2. Solve basic problems in linear algebra such as determining determinant, Gauss method, matrix product, solving system of equations with many unknowns, ... Know how to solve the problem of linear programming by geometry, simplex algorithms; Understand and explainable the terms in the linear programming.
3. Know some practical applications of linear algebra and simulation using numpy, scipy, simple software packages. Know the advanced content of linear programming: the big M technique to find the basis in the simplex algorithm, the concept of duality and relate to the original article.
4. Study the advanced contents on linear algebra such as PCA, SVM and solving linear programming problem on Python. Know how to apply linear programming to problems: integer programming, transportation problems, game theory.

REQUIRED AND RECOMMENDED READING

[1] Linear Programming - Foundations and Extensions, Robert J.Vanderbei, 2020, Springer.

CSC10105 - Introduction to Algorithmic Thinking

GENERAL INFORMATION

Course ID:	CSC10105
Course name (English):	Introduction to Algorithmic Thinking
Course name (Vietnamese):	Nhập môn tư duy thuật toán
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Programming Techniques

COURSE DESCRIPTION

The course is designed to provide students with knowledge in many essential topics related to competitive programming, including data structures, recursion, dynamic programming, graph theories, string processing and optimization, geometric computation, greedy and mathematical algorithms.

During the course, students are also trained in their coding skills, their thinking mindset, and coding interviewing skills such as algorithm explanation, complexities optimization, etc.

COURSE GOALS

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

1. Understanding complexities, in terms of space and time.
2. Learning essential data structures.
3. Studying a variety of algorithms in many topics related to competitive programming and coding interview questions.
4. Training and practicing to gain problem analyzing, explaining, optimizing skill sets.
5. Getting used to coding interviewing processes.
6. Experimenting coding interviewing processes.

REQUIRED AND RECOMMENDED READING

[1] Algorithms and complexity. Vol. 1., Meurant, Gerard, 2014, Elsevier.

[2] Cracking the coding interview: 189 programming questions and solutions, McDowell, Gayle Laakmann, 2015, CareerCup, LLC.

CSC10106 - Combinatorial Algorithms and Applications

GENERAL INFORMATION

Course ID: **CSC10106**
Course name (English): **Combinatorial Algorithms and Applications**
Course name (Vietnamese): **Thuật toán tổ hợp và ứng dụng**
Relation to curriculum: **Specializations (elective)**
Credit points: **4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits**
Prior course(s):

REQUIRED AND RECOMMENDED READING

[1] An Introduction to Combinatorics and Graph Theory, David Guichard, 2022, Creative Commons.

CSC10107 - Internship

GENERAL INFORMATION

Course ID:	CSC10107
Course name (English):	Internship
Course name (Vietnamese):	Thực tập thực tế
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 2; Laboratory: 2) / ~ 6 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course is to give students opportunities to know and experience the real working context at a Computer Science company or professional organization as full-time interns. The.

(student) interns will be able to take part in the company's real projects. They can discover organization structures, roles and responsibilities within that structure, the processes applied at the company; demonstrate their own knowledge, techniques and professional skills; and comprehend the company culture or etiquette rules. Through the course, students could make more connections with people in the same professional field, gain insight into a career path for their future job, and build their professional manners and attitude to adapt in the business and industrial environment. Students can choose which company to take the internship by their own based on the "Call for Internship" posts in the official faculty or university websites, or in other websites, media, etc. The company is not limit in Ho Chi Minh city or in Viet Nam. Students are encouraged to take their internship in foreign countries.

The internship is required related to information technology field (for examples, application/system design, application/system analysis, application/system building, application/system testing, etc.), and not limit to any programming languages, frameworks, operation systems, types of application. The internship must be full time and not less than 12 weeks.

COURSE GOALS

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

1. Apply what they have learned in the classroom to the corporate setting, make professional contributions to the organization in which the student is placed.
2. Adapt the business and industrial environment in which a computer professional must learn to function.
3. Develop the personal, interpersonal skills and charactersitics in the working environment.
4. Improve their foreign language skills.

CSC10108 - Data Visualization

GENERAL INFORMATION

Course ID:	CSC10108
Course name (English):	Data Visualization
Course name (Vietnamese):	Trực quan hóa dữ liệu
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course is designed to provide students a fundamental knowledge of visual representation of data to create “visual information” that allows to see trends, highlights, patterns of data, outliers, or other important information that we can't see if we only look at the original data. Students will learn how computers display information graphically and how humans perceive information visually. Students will also learn the formal categories of data, including quantitative and qualitative data, and how they are properly mapped with visual elements so that users perceives well the meaning of the data. The course will integrate data visualization into data mining systems to support decision-making and build visual dashboard.

COURSE GOALS

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

1. Conduct data analysis and visual design in cooperation with team members.
2. Use English documents related to data visualization skills.
3. Practice critical thinking while working on data visualization tasks.
4. Use data analysis methods and data visualization tools to visually represent a variety of data types.
5. Evaluate the meaning of visualization.

REQUIRED AND RECOMMENDED READING

[1] Better Data Visualizations: A Guide for Scholars, Researchers, and Wonks, Jonathan Schwabish, 2021, Columbia University Press.

CSC10121 - Personal and Interpersonal Skills

GENERAL INFORMATION

Course ID:	CSC10121
Course name (English):	Personal and Interpersonal Skills
Course name (Vietnamese):	Kỹ năng mềm
Relation to curriculum:	Specializations (elective)
Credit points:	3 credits (Theory: 2; Laboratory: 1) / ~ 4 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course aims to provide students with basic knowledge and practices of soft skills such as communication, presentation, expression of ideas, personal management, problem-solving and decision-making, collaboration and teamwork skills. This course setup an environment for students to work in teams and practice soft skills that complement team-work through the course project.

Through this course, students gain dynamism, confidence, and grasp important principles in thinking, communicating, and team-working.

COURSE GOALS

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

1. Understand the importance of soft skills in life and career path.
2. Understand principles and apply basic thinking skills.
3. Understand principles and apply basic presentation skills.
4. Understand principles and apply basic communication skills.
5. Understand principles and apply basic teamwork skills.
6. Honesty and responsibility.

REQUIRED AND RECOMMENDED READING

[1] Thinking, Fast and Slow, Daniel Kahneman.

[2] 6 Thinking hats, Edward de Bono.

[3] Critical Thinking: Tools for Taking Charge of Your Professional and Personal Life, Richard W. Paul & Linda Elder.

CSC11002 - Telecommunication Systems

GENERAL INFORMATION

Course ID:	CSC11002
Course name (English):	Telecommunication Systems
Course name (Vietnamese):	Hệ thống viễn thông
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Computer Networking

COURSE DESCRIPTION

This is a course of specialized knowledge that is mandatory for students majoring in computer networking and telecommunications. This course aims to provide students with an overview of telecommunications systems, helping them understand the basic concepts and the factors related to the general communication process. During this course, students gain practical experience in the process of building a VoIP telephone system. Students will learn the components and operating models of Vietnam's telecommunications systems, the telecommunications services being provided and the services prepared for deployment in Vietnam, as well as global development trends.

COURSE GOALS

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

1. Apply some skills at the individual and the teamwork level to present problems in the Computer Networking, Telecommunication.
2. Use the specialized English terminology in Computer Networking, Telecommunication.
3. Show, explain and think at the system level to explain basic concepts, terminology, ... in Computer Networking, Telecommunication.
4. Sketch and demonstrate the relationship between the basic components, the principle of operation, the key characteristics of some telecommunication services /telecommunication systems that are being implemented in practice.
5. Use tools to construct and modify some services and systems Voice IP between devices and the actual telecommunication networks.

REQUIRED AND RECOMMENDED READING

- [1] Fundamentals of Telecommunications, 2nd edition, Roger L. Freeman, 2013, Wiley-IEEE Press;.
- [2] The Essential Guide to Telecommunication, 6th Edition, Annabel Z. Dodd, 2019, Prentice Hall.
- [3] Building a telephony systems with Asteisk, David Gomillion, Barrie Dempster, 2005, Packt Publishing.
- [4] Principles of Mobile Communication, Fourth Edition, Gordon L. Stüber, 2017, Springer International Publishing.
- [5] Asterisk: The Definitive Guide: Open Source Telephony for the Enterprise, 5th Edition, Jim Van Meggelen, 2019, O'Reilly Media.

CSC11003 - Computer Network Programming

GENERAL INFORMATION

Course ID:	CSC11003
Course name (English):	Computer Network Programming
Course name (Vietnamese):	Lập trình mạng
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Operating Systems, Computer Networking

COURSE DESCRIPTION

The course is designed to extend student's knowledge and practice in send/receive data across a network, provide/invoke services over a network. It is also the discipline of designing and implementing network programs. Student also have knowledge and skills to integrate security features into the network programs in an advanced level.

COURSE GOALS

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

1. Use socket concepts and describe application models in network.
2. Show design models of network programs.
3. Show complex design models of network programs.
4. Analyze and conduct design network programs depending on different scenario.
5. Produce network programs from design using C/C++ programming language.
6. Employ the security network programs.

REQUIRED AND RECOMMENDED READING

- [1] Unix Network Programming: The Sockets Networking Api, W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, 2003, Addison-Wesley Professional.
- [2] Hands-On Network Programming with C: Learn socket programming in C and write secure and optimized network code, Lewis Van Winkle, 2019, Packt Publishing.

CSC11004 - Advanced Computer Networking

GENERAL INFORMATION

Course ID:	CSC11004
Course name (English):	Advanced Computer Networking
Course name (Vietnamese):	Mạng máy tính nâng cao
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Computer Networking

COURSE DESCRIPTION

The course is to provide students advanced knowledge and skills in the field of Computer Networking. After completing the course, students can explain in-depth topics as well as current new network technology trends such as: TCP Congestion Control, Queue Management and QoS, IPv6, Internet Routing, Virtualization and Cloud computing, Software Defined Network (SDN), DevOps. In addition, students can apply the knowledge they have learned to install and configure related services and technologies, and can develop SDN projects at a basic level. The course also helps students to have practical experience on the process of building simple networks & services in virtualized environments, cloud computing.

COURSE GOALS

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

1. Apply some skills at the individual and the teamwork level to present problems in the Computer Networking.
2. Use the specialized English terminology in Computer Networking.
3. Explain the problem of congestion control and quality of service management on the Internet.
4. Explain and practice configuring Internet Routing.
5. Explain and practice configuring IPv6, Software Defined Network, Virtualization systems, Cloud Computing, Containers, DevOps.
6. Use support software tools to construct SDN programs, and practice on the advanced fields of computer network.

REQUIRED AND RECOMMENDED READING

[1] Computer Networking: A Top-Down Approach 8th Edition, James Kurose (Author), Keith Ross (Author), 2020, Pearson.

CSC11005 - Computer Network Laboratory

GENERAL INFORMATION

Course ID:	CSC11005
Course name (English):	Computer Network Laboratory
Course name (Vietnamese):	Thực tập Mạng máy tính
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Advanced Computer Networking, Computer Networking

COURSE DESCRIPTION

The course is designed to provide students with principles knowledge of common network protocols and network devices as well as how to configure those devices. It will also provide students with the skills to use simulation tools and software to simulate the operation of the network system for future research. Upon completion of the course, students will have the necessary skills and knowledge to operate and manage a small and medium-sized network based on specific policies and requirements.

COURSE GOALS

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

1. Apply some skills at the individual and the teamwork level to present problems in the Computer Networking.
2. Use the simulation tools & software to illustrate the various network topology.
3. Distinguish and practice both static and dynamic routing protocols.
4. Manipulate switching protocols operating at Layer 2 and Layer 3.
5. Apply WAN techniques to help connect small and medium sized networks.
6. Categorize IP Multicast, IPv4 and IPv6 address translation techniques.

REQUIRED AND RECOMMENDED READING

[1] Switching, Routing, and Wireless Essentials Companion Guide (CCNAv7) 1st edition, Cisco Networking Academy, 2020, Pearson.

CSC11103 - Computer Network Design

GENERAL INFORMATION

Course ID:	CSC11103
Course name (English):	Computer Network Design
Course name (Vietnamese):	Thiết kế mạng
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Computer Networking

COURSE DESCRIPTION

The course is designed to provide students with the basic concepts of designing a network computer. Basing on the a top-down approach, students can design a network computer, start with business goals, constraints to design logic, physics, testing and optimization. The course introduces technique that allow design from network units (one center, one speed) to complex networks (n centers, n speeds). The course also updates design network with WLAN, WiMAX, VPN.

COURSE GOALS

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

1. Show and solve the requirements and goals when designing a computer network.
2. Use the specialized English terminology in Computer Networking.
3. Analyze and apply network algorithm (Access Network) from simple (one center, one speed) to complex (n centers, n speed) following the steps in the top-down design.
4. Plan the steps to take for designing a wireless network, VPN. Apprise and modify the network system after design and implementation.
5. Use the appropriate network devices for each specific type of network in the different context. Basic configuration of Router and Switch of Cisco.

REQUIRED AND RECOMMENDED READING

- [1] Top-Down Network Design, Oppenheimer Priscilla, 2010, Cisco Press.
[2] Art of Network Architecture, The: Business-Driven Design (Networking Technology), Russ White, Denise Donohue, 2014, Cisco Press.

CSC11106 - Wireless Communications

GENERAL INFORMATION

Course ID:	CSC11106
Course name (English):	Wireless Communications
Course name (Vietnamese):	Truyền thông không dây
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Computer Networking

COURSE DESCRIPTION

The course wireless communications covers many aspects of mobile and wireless communication systems. Topics to be covered include: introduction to wireless communications, wireless transmission, medium access control, telecommunication systems, wireless LAN, ad-hoc networks, protocols and security in wireless networks.

COURSE GOALS

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

1. Apply some skills at the individual and the teamwork level to present problems in the Computer Networking, Wireless Communications.
2. Distinguish and use the specialized English terminology in Computer Networking, Wireless Communications.
3. Explain and think at the system level.
4. Demonstrate and classify the basics of the Computer Networking, Wireless Communications.
5. Distinguish and generate solutions to basic wireless network problems. Use basic algorithms learned to solve real problems. Analyze and design some wireless networks, routing in wireless networks.
6. Use network simulation tools, mobile application programming tools, combines with wireless network protocols and security knowledge to construct mobile applications.

REQUIRED AND RECOMMENDED READING

[1] , 2nd Edition, Jochen H. Schiller, 2003, Addison-Wesley.

CSC11107 - Digital Communications

GENERAL INFORMATION

Course ID:	CSC11107
Course name (English):	Digital Communications
Course name (Vietnamese):	Truyền thông kỹ thuật số
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Computer Networking

COURSE DESCRIPTION

The course is designed to provide students specialized knowledge about Computer Networks and Telecommunications. This course covers the exchange of between two directly connected devices, students can understand about Physical and Link layers. This course also includes data transmission, signal encoding techniques and multiplexing. Students should be able to use simulation tools to build the system for future research.

COURSE GOALS

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

1. Show good skills in teamwork and independent work.
2. Use the specialized English terminology in Computer Networking, Telecommunication.
3. Interpret and imply the basic concepts of Digital Communications.
4. Understand and demonstrate, compare pulse modulation (PM) and pulse code modulation (PCM), analog and digital modulation.
5. Understand and experiment data transmission and signal encoding techniques, channel encoding.
6. Use simulation software to construct simulated systems.

REQUIRED AND RECOMMENDED READING

- [1] Digital Communications, Proakis J.G, 2001, McGraw Hill, USA.
- [2] Digital Communications: Fundamentals and Applications, Bernard Sklar, 2001, Prentice Hall P T R.
- [3] Nguyên lý thông tin tương tự - số, Vũ Đình Thành, 2006, NXB ĐHQG TPHCM.

CSC11111 - Advanced Topics in Computer Networking

GENERAL INFORMATION

Course ID:	CSC11111
Course name (English):	Advanced Topics in Computer Networking
Course name (Vietnamese):	Chuyên đề tốt nghiệp Mạng máy tính
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Computer and Network Service Administration, Computer Network Programming

COURSE DESCRIPTION

The subject provides students with knowledge and skills on trending, important and necessary topics for an engineer and expert in the field of Computer Networks: network monitoring skills; explore the security issues of each protocol in the TCP/IP protocol stack; understand the common security vulnerabilities of web applications and popular password cracking techniques; have skills in performance management of the network system; Cybersecurity attack and defense strategies...

COURSE GOALS

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

1. Combines more skills in proficient reading professional English documents and more skills in individual and team working.
2. Tell and describe the nature of security issues in the TCP/IP protocol suite.
3. Discover, recommend solutions to limit common security vulnerabilities of web applications.
4. Develop an effective password protection policy.
5. Self-develop the basics in CyberSecurity.
6. Use tools for network monitoring, network performance monitoring, web application hacking, Password Cracker.

REQUIRED AND RECOMMENDED READING

- [1] Cybersecurity ` Attack and Defense Strategies, Yuri Diogenes Erdal Ozkaya, 2018, Packt (Birmingham - Mumbai).
- [2] CEH V.12, ECCouncil.org, 2022, ECCouncil.org.

CSC11112 - Advanced Topics in Distributed System

GENERAL INFORMATION

Course ID:	CSC11112
Course name (English):	Advanced Topics in Distributed System
Course name (Vietnamese):	Chuyên đề Hệ thống phân tán
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course is designed to provide students an overview of distributed systems, the background knowledge related to the core components in distributed systems (distributed system concepts, events, clock, event order, synchronization and consistency...). The course also helps build foundational knowledge for in-depth study of distributed systems, helping students come up with solutions for application software on computer networks.

COURSE GOALS

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

1. Use the specialized English terminology in Operating System.
2. Use the specialized English terminology in Computer Networking.
3. Explain and illustrate basic concepts, terms,... belonging to the distributed systems.
4. Distinguish and use the algorithms in the different contexts of the distributed systems.
5. Produce some small applications in a distributed environment.

REQUIRED AND RECOMMENDED READING

[1] Distributed Systems 3rd Edition, Maarten van Steen, Andrew S. Tanenbaum, 2017, CreateSpace Independent Publishing Platform.

CSC11113 - Computer and Network Service Administration

GENERAL INFORMATION

Course ID:	CSC11113
Course name (English):	Computer and Network Service Administration
Course name (Vietnamese):	Quản trị dịch vụ mạng
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Computer Networking

COURSE DESCRIPTION

The course Computer and Network Administration is intended to provide students with basic and advanced knowledge in network services administration (operating system knowledge: user management, file system management, software installation and management, etc.) software...; knowledge of computer networks: setting up network configuration, services: DNS, DHCP, SSH, FTP, Web, Mail, Firewall, VPN, Proxy...). The subject emphasizes practice, students need to implement a network system applicable to small and medium-sized enterprises during the course of their studies, helping to approach closer to reality and through which students form new ideas. knowledge and skills to build models and solutions for enterprise network systems.

COURSE GOALS

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

1. Apply some skills at the individual and the teamwork level to present problems and deploy computer and network services on Linux, Windows Server.
2. Distinguish and use the specialized English terminology in computer and network services on Linux, Windows Server.
3. Analyze, think at the system level to discover and fix problems that occur during the design, implementation, and operation of network services using Linux and Windows Server.
4. Set up and manage Linux and Windows Server operating systems, network services in the intranet and on the Internet.
5. Design, deploy, manage network applications on Linux environment, Windows Server is widely used in practice.

REQUIRED AND RECOMMENDED READING

[1] Pro Linux System Administration (Expert's Voice in Open Source) 1st Edition, James Turnbull, Peter Lieverdink and Dennis Matotek, 2009, Apress.

[2] A Practical Guide to Linux Commands, Editors, and Shell Programming (3rd Edition), Mark G. Sobell, 2012, Pearson.

CSC11115 - Network Security

GENERAL INFORMATION

Course ID:	CSC11115
Course name (English):	Network Security
Course name (Vietnamese):	An ninh mạng
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Computer Networking

COURSE DESCRIPTION

The course will strike a balance between encryption and computer system and network security issues. The first part of the course is about data encryption techniques and the second part is about security protocols on the network such as PGP, IPSec, SSL/TLS,...; problems on attacking and protecting computer networks: Denial-of-Service, DNS Cache Poisoning, Buffer Overflow, Dictionary, Viruses, worms and Trojans, Firewall and Intrusion detection.

COURSE GOALS

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

1. Apply some skills at the individual level and self-manage group collaboration to address some of the computer security issues.
2. Know, explain, and apply specialized English terms.
3. Explain and illustrate basic concepts, terminology, responsibilities, work and basic ethical principles... in the field of cybersecurity.
4. Identify, classify and demonstrate computer & software attack threats.
5. Understand and conduct at a basic level security software.
6. Sketch and conduct security in the software development process, and the software operation. Using software tools that support network security.

REQUIRED AND RECOMMENDED READING

[1] Computer security principles and practice, William Stallings, Lawrie Brown, 2017, Pearson.

CSC12001 - Data Security in Information Systems

GENERAL INFORMATION

Course ID:	CSC12001
Course name (English):	Data Security in Information Systems
Course name (Vietnamese):	An toàn và bảo mật dữ liệu trong hệ thống thông tin
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Databases

COURSE DESCRIPTION

The course is designed to provide students with the concepts of information security. Students understand that the database is an important part of an information system. The course presents an introduction to security issues and the threats to databases that are stored in trusted servers. The student can recognize the security requirements and apply the mechanisms such as user authentication, access control, data encryption, auditing for securing databases in real-world information systems. Students also study the context that the databases to be stored in untrusted servers which introduces a lot of security issues. The course provides some suggested solutions for each issue.

COURSE GOALS

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

1. Apply soft skills to independently or in group to apply security mechanisms of RDBMSs.
2. Practice the reading comprehension skills, and rewrite simple reports in English.
3. Explain basic concepts in information security.
4. Recognize the security requirements in an information system.
5. Explain the principles of security schemes or mechanisms provided by RDBMSs for enforcing the security requirements in real-world information systems.
6. Apply security mechanisms provided by DBMSs in real-world information systems.
7. Illustrate SQL Injection attacks and operate defense methods.
8. Explain security issues in ODBS (Outsourced Database Services) and apply security policies in an outsourced database.

REQUIRED AND RECOMMENDED READING

[1] Oracle Database 12c Security 1st Edition, Scott Gaetjen, David Knox, William Maroulis, 2015, McGraw Hill.

[2] Fundamentals of database systems, Elmasri & Navathe, 2017, Pearson Education Inc.

CSC12002 - Advanced Database Systems

GENERAL INFORMATION

Course ID:	CSC12002
Course name (English):	Advanced Database Systems
Course name (Vietnamese):	Cơ sở dữ liệu nâng cao
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Databases

COURSE DESCRIPTION

This course aims to equip students with advanced knowledge in the field of relational database design. The content of the course focuses on four phases in database design: collecting and analyzing user requirements, conceptual database design, logical database design, and physical database design. In conceptual database design, students learn how to determine user requirements for data and develop data models to represent those requirements. Logical specifications, which map the conceptual requirements into the data model associated with a specific database management system. In the conceptual and logical design phases, the role of functional dependency will be discussed, especially related to the issues of integrity constraints checking, quality assessment of database schema and selecting the right database schema associated with information system requirements. In physical database design, students learn how to transform the requirements for data storage developed during database analysis into specifications to guide database implementation. Physical specifications, which indicate all the parameters for data storage that are then used as input for database implementation. During this phase, the content of course also focuses on how to select the appropriate physical techniques (index, data fragment, partition) for efficient queries on a specific relational database management system such as MS SQL, Oracle. In addition, the content of the course also introduces some new popular databases today, such as NoSQL database, geographic information database and other types of databases on the Internet.

COURSE GOALS

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

1. Practice teamwork skills.
2. Practice reading English documents related to relational database design.
3. Practice critical and creative thinking in relational database design.
4. Explain the meaning and importance of relational databases design.
5. Practice and applying the basic knowledge for the relational database design phases such as data models, functional dependency, normal form, ...
6. Apply some techniques to get user requirements.
7. Execute the tasks in the conceptual and logical database design.
8. Execute the tasks in the physical design phases.
9. List some modern popular databases currently.

REQUIRED AND RECOMMENDED READING

[1] Modern Database System, 12th edition, Jeff Hoffer, Ramesh Venkataraman, 2016, Pearson Education.

CSC12003 - Database Management Systems

GENERAL INFORMATION

Course ID:	CSC12003
Course name (English):	Database Management Systems
Course name (Vietnamese):	Hệ quản trị cơ sở dữ liệu
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Databases

COURSE DESCRIPTION

This course is designed to provide students concepts, principles and techniques used in relational database management systems. The course helps students to operate on a relational database consistently using transactions. Students are also introduced to concurrency control techniques used in a RDBMS for ensuring correctness and effectiveness in an information system. Students could understand techniques used for database recovery from failures in a DBMS. Students could also apply security mechanisms provided by a DBMS. In addition, they could understand how data is stored and retrieved on storage devices. Students are also introduced to the query processing algorithms and query optimization methods. In particular, students are guided to work in groups on exercises or course projects. Students are also instructed to perform reading comprehension skills and write simple reports in English.

COURSE GOALS

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

1. Apply soft skills independently or in group to apply principles of RDBMSs.
2. Practice the reading comprehension skills, present and write simple reports in English.
3. Use the functions of a RDBMS, analysis and design to solve real-world information systems.
4. Describe the general architecture of a DBMS.
5. Operate on a relational database consistently using transaction processing concepts and theory.
6. Use concurrency control techniques provided by DBMSs.
7. Explain the techniques used in DBMSs for database recovery from failures.
8. Apply security mechanisms provided by DBMSs in real-world applications.
9. Demonstrate the way data is stored or retrieved on storage devices.
10. Use the query processing algorithms and query optimization methods.
11. Apply functions provided by SQL Server together with a programming language in real-world information systems.

REQUIRED AND RECOMMENDED READING

- [1] Fundamentals of database systems, Elmasri & Navathe, 2017, Pearson Education Inc.
- [2] Database systems: The complete book, Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom, 2013, Pearson.

CSC12004 - Information Systems Analysis and Design

GENERAL INFORMATION

Course ID:	CSC12004
Course name (English):	Information Systems Analysis and Design
Course name (Vietnamese):	Phân tích thiết kế hệ thống thông tin
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Databases

COURSE DESCRIPTION

The purpose of this course is to familiarize students with concepts, methods, and tools for object-oriented analysis and design of computers based on information systems. This course provides students with both a theoretical and practical appreciation for the wide range of issues that are related to the development of a computing information system. Though the emphasis is on analysis and design skills, students will become familiar with the whole software lifecycle from ‘user requirements’ through to ‘implementation’ and ‘testing’. The teaching of the software lifecycle, especially those aspects involving ‘modeling’ – the use of a modeling language to capture analyses and designs, is placed in the context of diverse and contemporary organizations (commercial, scientific, cultural) and their computing systems. An important aspect of the course will be lab sessions where students will be guided to use CASE tools; programming languages and databases.

COURSE GOALS

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

1. Practice teamwork skills.
2. Practice reading course’s documents in English.
3. Practice critical and creative thinking in information system analysis and design.
4. Explain of the processes and stages to build and develop an automation information system in organization.
5. Use case tools for domain and requirements analysis, modeling, program visualization, and object-oriented program design.
6. Practice modeling for the static and dynamic components of information systems.
7. Collect specific technologies to design and build information systems application.
8. Explain of the system deployment in a business environment, the importance of user guidance and training.

REQUIRED AND RECOMMENDED READING

- [1] Phân tích và thiết kế Hệ Thống Thông Tin hướng đối tượng, Phạm Nguyễn Cương, Nguyễn Trần Minh Thư, Hồ Bảo Quốc, 2016, NXB Khoa học kỹ thuật.
- [2] Giáo trình phân tích thiết kế hệ thống thông tin, Phạm Nguyễn Cương, Nguyễn Trần Minh Thư, Hồ Bảo Quốc, 2017, Nhà xuất bản khoa học kỹ thuật.

CSC12005 - Modern Information Systems Development

GENERAL INFORMATION

Course ID:	CSC12005
Course name (English):	Modern Information Systems Development
Course name (Vietnamese):	Phát triển ứng dụng hệ thống thông tin hiện đại
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Information Systems Analysis and Design

COURSE DESCRIPTION

The course is designed to address students' cognitive concerns with information system (IS) application development in the present technical environment. The two major topics in this course are knowledge in application development and advanced information systems. The first topic helps students build an IS application with phases such as user requirement identification, system design and analysis, and implementation. The second topic helps students present an advanced point in information system application development, such as mobile information systems, NoSQL, micro-service architecture style,...

COURSE GOALS

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

1. Apply the use of group working techniques to discuss and present issues related to the development of information system applications.
2. Use English documents related to the problems of application development.
3. Practice critical and creative thinking in the application development of information systems.
4. Apply the basic knowledge to serve the development stages of information system application (including: identifying user requirements, models representing user request survey results, systems design and analysis results at levels) and related programming technologies to implement the functions of the information system application.
5. Practice some advanced topics in the application of the information system application present.
6. Apply techniques for identifying user requirements, analyze and compare existing information system issues, and construct solutions.
7. Practice for analyzing and designing information systems.
8. Apply some modern technologies for developing information systems.
9. Explain some advanced topics in information systems.

REQUIRED AND RECOMMENDED READING

- [1] Phân tích và thiết kế Hệ Thống Thông Tin hướng đối tượng, Phạm Nguyễn Cương, Nguyễn Trần Minh Thư, 2016, NXB Khoa học kỹ thuật.
- [2] Introduction to Information Systems, James O'Brien, 2009, Mcgraw Hill Higher Education.
- [3] Systems Analysis and Design, Harry J. Rosenblatt, Gary B. Shelly, 2011, Cengage Learning.
- [4] Information Systems Development: Business Systems and Services: Modeling and Development, Jaroslav Pokorny, Vaclav Repa, Karel Richta , Wita Wojtkowski, Henry Linger, Chris Barry, Michael Lang, 2011, Springer.

CSC12102 - Special Topics in Information Systems

GENERAL INFORMATION

Course ID:	CSC12102
Course name (English):	Special Topics in Information Systems
Course name (Vietnamese):	Chuyên đề chọn lọc trong Hệ thống thông tin
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Databases

COURSE DESCRIPTION

Nowadays, people face information overload. It is necessary to build a system that returns information related to the queries that users provided. That is an information retrieval system. In this course, we provide the basic principles and algorithms of information retrieval systems. In addition, we have introduced the recommender systems.

COURSE GOALS

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

1. Practice teamwork to solve problems related to information retrieval systems.
2. Use skills in reading English documents about information retrieval systems.
3. Practice critical, creative thinking in information retrieval systems.
4. Practice research skills.
5. Use relevant technologies.

REQUIRED AND RECOMMENDED READING

[1] Introduction to Information Retrieval, Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze., 2008, Cambridge University Press.

CSC12103 - Advanced Topics in Database Management Systems

GENERAL INFORMATION

Course ID:	CSC12103
Course name (English):	Advanced Topics in Database Management Systems
Course name (Vietnamese):	Chuyên đề Hệ quản trị cơ sở dữ liệu nâng cao
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Database Management Systems

COURSE DESCRIPTION

This course is designed to help students understand principles and operation of the components in a specific Database Management System (eg. Oracle Database). Thereby, they will have a comparative view between the practical implementation and the corresponding theoretical techniques (learned in the Database Management System course).

Students will gain background knowledge to use a specific commercial Database Management System as a database administrator.

Furthermore, students will also be able to practice some soft skills: teamwork skills, document reading skills, problem presentation skills,...

COURSE GOALS

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

1. Use the ability to collaborate in groups and explain database-related issues.
2. Use skills of reading technical documents on databases in English.
3. Practice critical and creative thinking in perceiving the issues of database management systems.
4. Experiment with different storage structures in different commercial database management systems.
5. Set up the mechanisms to exploit databases in a specific commercial database management systems.
6. Use the safety and security mechanisms in a specific commercial database management systems.

REQUIRED AND RECOMMENDED READING

- [1] Fundamentals of database systems, Elmasri & Navathe, 2017, Pearson Education Inc.
- [2] Database systems: The complete book, H. Garcia-Molina, J. D. Ullman, J. Widom, 2014, Prentice Hall.
- [3] Oracle Enterprise Manager Concepts.
- [4] PL/SQL User guide and Reference, Tom Portfolio, 1992, Oracle Corp.

CSC12105 - Electronic Commerce

GENERAL INFORMATION

Course ID:	CSC12105
Course name (English):	Electronic Commerce
Course name (Vietnamese):	Thương mại điện tử
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Database Management Systems, Information Systems Analysis and Design

COURSE DESCRIPTION

The course briefly provides students with knowledge of fundamentals of electronic commerce (e-commerce), online business models, e-commerce infrastructures and software, electronic payment models, internet marketing and advertising strategies, and web technologies.

COURSE GOALS

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

1. Explain underlying theories of e-commerce and the current situation of e-commerce in Vietnam.
2. Use critical thinking to apply business models, payment models, web technologies, and security solutions into e-commerce systems.
3. Discriminate marketing and advertising strategies for electronic marketplaces.
4. Construct a complete e-commerce system by integration and implementation.
5. Use soft skills to work in a team to present e-commerce topics.

REQUIRED AND RECOMMENDED READING

[1] Electronic Commerce 2018: A Managerial and Social Networks Perspective, Efraim Turban • Jon Outland • David King Jae Kyu Lee • Ting-Peng Liang Deborah C.Turban, 2018, Springer Texts in Business and Economics.

CSC12106 - Human-Computer Interaction

GENERAL INFORMATION

Course ID:	CSC12106
Course name (English):	Human-Computer Interaction
Course name (Vietnamese):	Tương tác người – máy
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Information Systems Analysis and Design

COURSE DESCRIPTION

The course is designed to provide students with knowledge on Human Computer Interaction (HCI) design, especially in the field of Information Systems (IS). Students will learn many interaction models and techniques in the design process, as well as interaction principles to create interactive products with high usability. In addition, usability evaluation methods are also provided for students to compare and select the best design helping to efficiently explore Information Systems.

COURSE GOALS

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

1. Execute with team members to exchange ideas during the interaction design process.
2. Show English documents/articles related to the application of HCI principles into Information Systems.
3. Practice critical and creative thinking in understanding problems of HCI in Information Systems.
4. Explain principles, models, and techniques of HCI in the field of Information Systems.
5. Apply principles, models, and techniques of HCI, as well as the interaction design to improve the interaction/interface in IS with purposes of usability and interactivity.
6. Practice in the usability and interactivity of interface designs in a specific IS.
7. Construct a new interaction/interface for a business process of IS by using interaction/interface support tools.

REQUIRED AND RECOMMENDED READING

- [1] Designing the user interface: Strategies for Effective Human-Computer Interaction, Ben Shneiderman và Catherine Plaisant, 2010, Addison Wesley.
- [2] Interaction Design beyond Human-Computer Interaction, Jenny Preece. Helen Sharp. Yvonne Rogers, 2015, Wiley.

CSC12107 - Information Systems for Business Intelligence

GENERAL INFORMATION

Course ID:	CSC12107
Course name (English):	Information Systems for Business Intelligence
Course name (Vietnamese):	Hệ thống thông tin phục vụ trí tuệ kinh doanh
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Databases

COURSE DESCRIPTION

The course is designed to provide students the knowledge and skills for using data warehouses (DW) for business intelligence (BI). Students can have an overview of how to develop data models, how to combine data from disparate sources into a single database and how BI technologies can support decision making such as OLAP on Data warehouse, data mining, dashboard and report.

COURSE GOALS

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

1. Apply teamwork skills to present or discuss related topics/concepts about DW and BI.
2. Use the skill of reading technical documents about data warehouse in English.
3. Analyze business requirements and applying the basic knowledge for the data warehouse design phases.
4. Distinguish the main data mining tasks and some algorithms for predictive and descriptive analysis on business intelligence.
5. Conduct a DW/BI project with MS BI tool.

REQUIRED AND RECOMMENDED READING

- [1] Building a Data Warehouse With Examples in SQL Server, Vincent Rainardi, 2008, Apress.
- [2] Business Intelligence Guidebook From Data Integration to Analytics, Rick Sherman, 2015, Elsevier.
- [3] Business Intelligence, Analytics, and Data Science: A Managerial Perspective (4th Edition), Ramesh Sharda, Dursun Delen, Efraim Turban, 2019, Pearson.
- [4] <https://learn.microsoft.com/en-us/sql/integration-services/sql-server-integration-services?view=sql-server-ver15>.
- [5] <https://www.mssqltips.com/sqlservertutorial/2000/sql-server-analysis-services-ssas-tutorial/>.

CSC12108 - Distributed Applications

GENERAL INFORMATION

Course ID:	CSC12108
Course name (English):	Distributed Applications
Course name (Vietnamese):	Ứng dụng phân tán
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Information Systems Analysis and Design

COURSE DESCRIPTION

This course aims to equip students with the necessary skills to develop a web application, focusing on two key areas: building a distributed application within the internet environment and constructing a distributed application using a microservices architecture.

The first part of the course aims to provide students with an understanding of how web applications function and the techniques required to develop them. Students will learn about the various components involved, including clients, web servers, and database servers. Additionally, the course will cover the utilization of web APIs to create interactive web applications. Emphasis will also be placed on web security principles to ensure the development of secure web applications. Moreover, students will be introduced to open-source technologies and emerging tools that facilitate web application development.

The second part will concentrate on teaching students techniques for designing and constructing distributed applications based on a microservices architecture. This segment of the course will delve into the concepts and principles behind microservices, enabling students to grasp the benefits and challenges associated with this architectural approach.

COURSE GOALS

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

1. Demonstrate the result of research problems that are assigned.
2. Use English terms and English literature related to web application building techniques and technologies.
3. Practice critical, creative thinking in building a high-quality Web application.
4. Explain the web applications distributed over the Internet environment and the workflow of building a web application from conception to deployment.
5. Apply related techniques and tools to build a complete Web application.
6. Illustrate distributed architecture patterns, including components and problems that need to be solved.
7. Design and construct a Web application based on a distributed architectural pattern.

REQUIRED AND RECOMMENDED READING

- [1] Building Microservices Designing Fine-Grained Systems (1st edition), Sam Newman, 2015, O'Reilly Media.
- [2] The Web Application Hacker's Handbook: Discovering and Exploiting Security Flaws (1st Edition), Dafydd Stuttard, Marcus Pinto, 2007, Wiley.

CSC12109 - Introduction to Enterprise Information Systems

GENERAL INFORMATION

Course ID:	CSC12109
Course name (English):	Introduction to Enterprise Information Systems
Course name (Vietnamese):	Hệ thống thông tin doanh nghiệp
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Databases

COURSE DESCRIPTION

This course provides students with an overview of the field of information systems and the background knowledge related to the key components of Enterprise information systems.

COURSE GOALS

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

1. Explain enterprise information systems: architecture, components, development processes, etc.
2. Discuss types of information systems and technologies.
3. Describe the challenges of information systems development.

REQUIRED AND RECOMMENDED READING

- [1] Introduction to Information Systems, George Marakas, James O'Brien, 2010, McGraw-Hill Irwin.
- [2] Phân tích và thiết kế Hệ Thống Thông Tin hướng đối tượng.

CSC12110 - Applied Data Analytics

GENERAL INFORMATION

Course ID:	CSC12110
Course name (English):	Applied Data Analytics
Course name (Vietnamese):	Phân tích dữ liệu ứng dụng
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Databases

COURSE DESCRIPTION

This course covers the basics from data analytics, to data warehouse design, and the principles for data visualization. It covers knowledge about the key concepts of data analysis and how to transform data into value, and provides a number of hands-on skills related to data analytics.

The course helps students understand a data ecosystem and its components, as well as the fundamentals of data analysis such as data collection or data mining. Students also gain the technical and soft skills required to have effective communication of the data to stakeholders, and master these skills. These can provide students with the option to become data-driven decision-making, through exploring Big Data platforms such as Hadoop, Hive, and Spark. The course also helps students explore the fundamentals of data collection and identifying data sources, and how to clean, analyze, and share their data using visualization tools and overview pages.

COURSE GOALS

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

1. Use soft skills to work individual or in collaboration to effectively present technical reports according to pre-defined templates of the course.
2. Use the key terminologies in English relating to data analysis.
3. Explain basic concepts, responsibilities, related works, and basic ethical principles to the data analysis.
4. Classify the different types of data analysis and the key steps in the data analysis process, and the roles and responsibilities involved.
5. Demonstrate data ecosystems, the different types of data structures, data formats, data sources, and data processing languages.
6. Execute techniques and tools for data identification, collection, cleaning, and processing.
7. Explain different statistical analysis tools and techniques, data visualization.

REQUIRED AND RECOMMENDED READING

- [1] Python for Data Analysis, Wes McKinney, 2018, OREILLY.
- [2] Business Intelligence, Analytics, and Data Science: A Managerial Perspective, Ramesh Sharda, Dursun Delen, Efraim Turban, 2019, Pearson.
- [3] <https://greenteapress.com/thinkstats2/thinkstats2.pdf>.

CSC12111 - Modern Database Management

GENERAL INFORMATION

Course ID:	CSC12111
Course name (English):	Modern Database Management
Course name (Vietnamese):	Quản trị cơ sở dữ liệu hiện đại
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Advanced Database Systems

COURSE DESCRIPTION

The emergence of big data and agile development methodologies have spurred the need for a new type of database system that can store and manipulate non-relational data easily. This course is intended to provide students with a perspective on various aspects of data management in modern database systems. The course also emphasizes the management of complex structured data, such as web data, social data, etc. NoSQL databases have gained a lot of relevance in the database landscape. Their main advantage is the ability to effectively handle scalability and flexibility issues raised by modern applications. In detail, the course covers advanced types of databases including NoSQL Databases, Time series Databases, Geospatial Databases, etc. For NoSQL databases, the course provides the main characteristics and how to implement the typical NoSQL databases, such as Key-value, columnar, document and graph and also familiarize them with the concept of a distributed networked file system. Students also learn tools and database management systems to create, store and query data in NoSQL environments and other types of databases.

COURSE GOALS

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

1. Practice teamwork skills.
2. Practice reading technique documents in English.
3. Practicing critical and creative thinking in study process.
4. Classify the types of modern databases applied in application domains today.
5. Choose the types of NoSQL databases (key-value stores, document databases, column-family stores, graph databases) and apply NoSQL data modeling from application specific queries.
6. Discuss the other types of modern databases including Geographic database, time-series database.
7. Discover and use NoSQL database management systems to implement types of modern databases through illustrated applications.

REQUIRED AND RECOMMENDED READING

- [1] Next Generation Databases: NoSQL. NewSQL and Big Data 1st ed. Edition, Guy Harrison, 2016, Apress.
- [2] NoSQL for Mere Mortals (1st edition), Dan Sullivan, 2015, Addison-Wesley Professional.
- [3] NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pramod J. Sadalage, Martin Fowler, 2012, AddisonWesley.

CSC13001 - Windows Programming

GENERAL INFORMATION

Course ID:	CSC13001
Course name (English):	Windows Programming
Course name (Vietnamese):	Lập trình Windows
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Object-Oriented Programming

COURSE DESCRIPTION

This course is designed to provide students with knowledge and techniques for creating graphical user interface application on Windows. Students will learn about how to create basic graphical user interface elements and handle events corresponding to a particular control. Two basic ways of handling user input are introduced in the course, including mouse and keyboard. Furthermore, essential aspects of Windows programming including Windows file system, hook and Dynamic linking library are discussed. Students will also be enhanced their programming skills with creating database powered application and calling API (Restful API and GraphQL API). Finally, students are instructed to perform reading comprehension skills and working in group to create a presentation based on a given research topic.

COURSE GOALS

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

1. Explain basic concepts of Windows graphical interface programming.
2. Use supporting tools to create graphical user interface application on Windows.
3. Solve Windows programming problem personally or interpersonally.
4. Apply teamwork skills to do research on a given topic and make presentation.
5. Practice creating a simple application that uses database.
6. Practice creating a simple application that call Restful API and GraphQL API.

REQUIRED AND RECOMMENDED READING

[1] Pro WPF 4.5 in C#: Windows Presentation Foundation in .NET 4.5, Matthew MacDonald, 2012, Apress.

[2] C# 11 and .NET 7 – Modern Cross-Platform Development Fundamentals: Start building websites and services with ASP.NET Core 7, Blazor, and EF Core 7, 7th Edition, Mark J. Price, 2022, Packt Publishing.

CSC13003 - Software Testing

GENERAL INFORMATION

Course ID:	CSC13003
Course name (English):	Software Testing
Course name (Vietnamese):	Kiểm thử phần mềm
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Software Engineering

COURSE DESCRIPTION

This course is for professionals and students who wish to gain a better understanding of software testing techniques and/or specialize in software quality engineering. The course will cover selected techniques for black box and white box testing, testing tools, and process and management issues. The seminar will be a blend of software testing concepts and theories with practical hands-on experience...

COURSE GOALS

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

1. Describe the fundamentals of software testing and its application through the software life cycle.
2. Practice skills in designing and executing software tests suitable for different stages in the software life cycle.
3. Apply teamwork skills to complete small projects required by the subject.
4. Produce the test plan for software projects.
5. Design and evaluate the test cases based on the software testing techniques.
6. Explain the role of software testing in systems development, deployment, and maintenance.
7. Develop a continuing interest in software testing, and obtain satisfaction from its study and practice.
8. Use appropriate methods and CASE Tools to test the software.

REQUIRED AND RECOMMENDED READING

- [1] Testing computer Software, Cem Kaner, Jack Falk, Hung Q. Nguyen, 1999, Wiley.
- [2] The Art of Software Testing 3rd Edition, Glenford J. Myers, Corey Sandler, Tom Badgett, 2013, Infiniti Books.
- [3] Complete Guide to Test Automation: Techniques, Practices, and Patterns for Building and Maintaining Effective Software Projects, Arnon Axelrod, 2018, Apress.

CSC13005 - Software Requirements Engineering

GENERAL INFORMATION

Course ID:	CSC13005
Course name (English):	Software Requirements Engineering
Course name (Vietnamese):	Phân tích và quản lý yêu cầu phần mềm
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Software Engineering

COURSE DESCRIPTION

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). The project will be a blend of Software Requirement concepts and theories with practical hands-on experience...

COURSE GOALS

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

1. Explain and apply the fundamentals of Software Requirement and its application through the software life cycle.
2. Develop skills in requirement developments suitable for different stages in the software life cycle.
3. Develop skills in requirement management.
4. Apply teamwork skills to complete small projects required by the subject.
5. Explain the role of Software Requirement in systems development, deployment, and maintenance.
6. Develop a continuing interest in Software Requirement, and obtain satisfaction from its study and practice.
7. Use appropriate methods and CASE Tools to model, manage the software requirements.
8. Develop a continuing interest in Software Requirement, and obtain satisfaction from its study and practice.

REQUIRED AND RECOMMENDED READING

- [1] Software Requirements, Karl Wiegiers and Joy Beatty, 2013, Microsoft Press.
- [2] The Requirements Engineering Handbook, Ralph R. Young, 2004, Artech House.
- [3] Software Requirements Essentials: Core Practices for Successful Business Analysis, Karl Wiegiers, Candase Hokanson, 2023, Addison-Wesley.
- [4] Software Requirements (Dv-Best Practices) 2E, Karl E. Wiegiers, 2003, Microsoft Press.

CSC13006 - Software Project Management

GENERAL INFORMATION

Course ID:	CSC13006
Course name (English):	Software Project Management
Course name (Vietnamese):	Quản lý dự án phần mềm
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Software Engineering

COURSE DESCRIPTION

The number of software projects that faced challenges or failures accounts for 70% of total projects (of which about 29% of total projects completely failed) . Many methods were proposed to increase the success of software projects such as proposing new programming languages, developing new technologies, building automation tools. Project management is one of the solutions which interests many researchers and is widely applied in the software industry.

This software project management course introduces the basic tools and techniques of software project management for students. The main goals include equipping students with the ability to plan, execute, monitor, track, and evaluate a software project.

Key topics include software development models (including a general life cycle model and specific processes such as waterfalls, RUP, Scrum, XP, Kanban with detailed activities) and project management techniques (project scope management, feasibility analysis conduction, project schedule management, project effort and cost estimation, contract negotiation, project execution, monitor, and control, team management, change management, risk management, configuration management, project quality management, project result evaluation).

This course also introduces an overview of the maturity level models and standards for improving the quality of software development process.

COURSE GOALS

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

1. Propose a software development model for a project.
2. Explain responsibility and ethics of a project manager when managing a software project.
3. Apply management activities to manage a software project, including determining the project scope, analyzing and selecting available products, estimating effort, time and cost of a software project, conducting feasibility analysis, creating a schedule, negotiating a contract, implementing, monitoring, and controlling a project x, leading team, change management, risk management, configuration management, project quality management, project result evaluation.
4. Practice engineering 75,000 lines of code software with a team of 7 people.
5. Use tools for managing software projects and software development processes.
6. Explain standards related to the software development process.

REQUIRED AND RECOMMENDED READING

[1] A Guide to the Project Management Body of Knowledge, Project Management Institute, 2021, Project Management Institute.

- [2] An Introduction to Project Management - 6E, Kathy Schwalbe, 2017, CreateSpace Independent Publishing Platform.
- [3] Making Things Happen: Mastering Project Management, Scott Berkun, 2008, O'Reilly Media.

CSC13007 - Game Development

GENERAL INFORMATION

Course ID:	CSC13007
Course name (English):	Game Development
Course name (Vietnamese):	Phát triển game
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Programming Techniques

COURSE DESCRIPTION

The course is designed to provide students with the basic knowledge and skills needed in game development. The course content provides an overview of the game development process, architecture, and basic components, and focuses on graphics techniques and animation effects in 2D (3D) graphics. With this course, students will know how to build interactive systems, sound systems, network protocols in the game, how to build, specify and handle scenarios and in-game event systems.

COURSE GOALS

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

1. Practice teamwork skills to discuss and to plan (small groups of about 2–3 students); Identify the roles and responsibilities of team members.
2. Summarize specialized documents in English on the analysis and software design and the technologies used; explain some English terms in software analysis and design; write reports (according to provided template) and present the group's project topic.
3. Explain an overview of the game development industry.
4. Apply algorithms, methods, tools and technologies to build 2D game (graphics and animation components).
5. Apply knowledge, skills, methods, tools and technologies to build other components in the game (audio, networking, event and scripting, artificial intelligence, interaction...).
6. Practice building a complete game at a simple level.
7. Explain the responsibility of game developers and the impact of games on society; Use other programming languages and game engines to develop games.

REQUIRED AND RECOMMENDED READING

- [1] Game Architecture and Design: A New Edition, Andrew Rollings and Dave Morris, 2003, New Riders Pub.
- [2] The Art of Game Design: A Book of Lenses, 3rd Edition, Jesse Schell, 2019, A K Peters/CRC Press.
- [3] 2D Game Development with Unity, Franz Lanzinger, 2020, CRC Press.
- [4] Game Development Patterns and Best Practices: Better games. less hassle, John P. Doran. Matt Casanova, 2017, Packt.
- [5] Video Game Level Design: How to Create Video Games with Emotion, Interaction, and Engagement, Michael Salmond, 2021, Bloomsbury Academic.

CSC13008 - Web Application Development

GENERAL INFORMATION

Course ID:	CSC13008
Course name (English):	Web Application Development
Course name (Vietnamese):	Phát triển ứng dụng web
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Programming Techniques, Introduction to Databases

COURSE DESCRIPTION

The course provides knowledge and techniques to students in developing web applications. Students will be presented the overview of web and internet, client-server model of the web applications as well as the detail steps in building a website. The course also presents the client-side and server-side technologies in developing web applications, the issues of and solutions to web security, the basic techniques and the tools in testing the web applications.

COURSE GOALS

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

1. Apply personal skills or teamwork skills to develop a real web application.
2. Practice self-learning, reading comprehension English document and making presentation about web development subjects.
3. Conduct a presentation about the overview of the operation mechanism of web applications, web application models and related technologies.
4. Practice analyzing, developing and deploying a complete small to medium-sized web application.
5. Design static web interfaces using HTML & CSS.
6. Practice programming Client-side processing using JavaScript.
7. Explain and practice designing and developing dynamic web applications with database connection using NodeJS.
8. Use supporting tools for web development.

REQUIRED AND RECOMMENDED READING

- [1] The Express Handbook, Flavio Copes, 2015, Flavio Copes.
- [2] The CSS Handbook, Flavio Copes, 2015, Flavio Copes.
- [3] <https://www.w3schools.com/>.
- [4] Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics 5th Edition, Jennifer Robbins, 2018, O'Reilly Media.
- [5] Web Development with Node and Express: Leveraging the JavaScript Stack 2nd Edition, Ethan Brown, 2019, O'Reilly Media.
- [6] Secure Your Node.js Web Application: Keep Attackers Out and Users Happy 1st Edition, Karl Duuna, 2016, Pragmatic Bookshelf.

CSC13009 - Mobile Application Development

GENERAL INFORMATION

Course ID:	CSC13009
Course name (English):	Mobile Application Development
Course name (Vietnamese):	Phát triển phần mềm cho thiết bị di động
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Programming Techniques, Introduction to Databases

COURSE DESCRIPTION

This subject provides all students with the overview of developing mobile application development, some knowledges relating to main components in this area (some background, environment development & tools, user interface designs, libraries, test and deploy the application on smart phones). Some topics in this subject include: User interface design; application life cycle management; storage & data access; multi-thread processing; data-sharing among applications; service management; inter-process communication; using map service & GPS; some functions like call & message, animation, multimedia, and cryptography. Operating system in smart phones presented in this subject may be changed with the technology trends of the world and Vietnam. Now, this subject uses Android to demonstrate how to develop the application in mobile devices.

COURSE GOALS

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

1. Practice teamwork skills to develop the mobile applications.
2. Explain the English terminologies in this area.
3. Explain basic concepts, responsibility, tasks and ethical issues... in this area.
4. Classify the background and environment of mobile application development.
5. Explain and use some basic techniques in development of mobile application.
6. Explain and practice building a small-scale application personally.
7. Use external tools to support the development in Android.

REQUIRED AND RECOMMENDED READING

- [1] Beginning iPhone Development with Swift 5: Exploring the iOS SDK, Wallace Wang, 2019, Apress.
- [2] Beginning iPhone Development with SwiftUI: Exploring the iOS SDK, Wallace Wang, 2022, Apress.
- [3] Android Programming for Beginners: Build in-depth, full-featured Android apps starting from zero programming experience, John Horton, 2021, Packt Publishing.
- [4] Head First Android Development, Dawn Griffiths, 2021, O'Reilly Media.
- [5] <https://developer.android.com/courses>.
- [6] Pro Android with Kotlin: Developing Modern Mobile Apps, Peter Späth, 2018, Apress.

CSC13010 - Software Design

GENERAL INFORMATION

Course ID:	CSC13010
Course name (English):	Software Design
Course name (Vietnamese):	Thiết kế phần mềm
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Software Engineering

COURSE DESCRIPTION

This course provides an introduction to the principles of analyzing and designing software based on software requirements. The course content primarily emphasizes the use of object-oriented techniques, utilizing Unified Modeling Language (UML) to analyze and design various aspects of software, including architecture, interfaces, business logic, and data. Optional advanced topics, such as design patterns and service-oriented architecture, may also be covered. By the end of the course, students will have a solid foundation in software analysis and design principles, with a specific focus on object-oriented techniques using UML. They will be equipped with the skills to analyze software requirements and design software architectures, interfaces, business logic, and data structures. Optional advanced topics will further expand their knowledge and enable them to tackle more complex software design challenges.

COURSE GOALS

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

1. Practice participating actively in group discussions (large groups), dividing the work and coordinate work according to plans in a small group (including 2-3 students); List roles and responsibilities of team members.
2. Summarize technical documents in English in the design of software and technologies used; explain English terms in software design; write report with given template and practice presenting on a specific group's topic.
3. Apply critical thinking and holistic thinking when designing software.
4. Explain the role of software design in the software development process, some of the main approaches to software design.
5. Apply object-oriented analysis method and fundamental principles in analysis to analyze software in small and medium scale, towards software evolution.
6. Apply object-oriented design methods and fundamental principles in the design division to design software in small and medium scale towards software evolution.
7. Assess the quality of the analysis and design modelling at a basic level and apply a number of designs to improve the quality of the analysis and design modelling.
8. Select and use several software engineering tools and environments to analyze and design software at a small and medium scale.

REQUIRED AND RECOMMENDED READING

[1] <https://refactoring.guru/>.

[2] Object-Oriented Analysis, Design and Programming with UML, Umar Lone, 2020, Packt.

- [3] Clean Architecture: A Craftsman's Guide to Software Structure and Design, Robert C. Martin, 2017, Pearson Professional.
- [4] Building Secure and Reliable Systems: Best Practices for Designing, Implementing, and Maintaining Systems, Heather Adkins, Betsy Beyer, Paul Blankinship, Ana Oprea, Piotr Lewandowski, Adam Stubblefield, 2020, O'Reilly Media.

CSC13101 - Advanced Topics in Software Engineering

GENERAL INFORMATION

Course ID:	CSC13101
Course name (English):	Advanced Topics in Software Engineering
Course name (Vietnamese):	Các chủ đề nâng cao trong Công nghệ phần mềm
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Software Engineering

COURSE DESCRIPTION

This is an elective course in the field of software engineering, discussing in-depth topics that have been attracting the attention of the research community as well as the software industry. This course provides students with advanced knowledge and skills in designing and developing software applications, such as knowledge and skills in applying software processes, cost analysis and estimation, test automation, continuous integration, and software architecture. Students are also equipped with basic research skills such as reading comprehension and summarizing scientific articles, and orally presenting an in-depth topic in the field of software engineering.

COURSE GOALS

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

1. Apply teamwork skills to complete group assignments as well as to present and report seminar topics.
2. Summarize scientific papers in the field of software engineering.
3. Analyze and evaluate issues related to advanced topics in software engineering covered in the course.
4. Recognize important trends having the attention of the software engineering community.
5. Describe and apply common approaches in software process, software estimation, software architecture, continuous integration, and test automation.

REQUIRED AND RECOMMENDED READING

- [1] The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim, Patrick Debois, John Willis, Jez Humble, John Allspaw, 2015, IT Resolution Press.
- [2] Practical DevOps - 2E, Joakim Verona, 2018, Packt.

CSC13102 - Java Application Programming

GENERAL INFORMATION

Course ID:	CSC13102
Course name (English):	Java Application Programming
Course name (Vietnamese):	Lập trình ứng dụng Java
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course is designed to strengthen basic programming knowledge with Java (basic syntax, basic and advanced data structure, object-oriented programming, etc.). In addition, it also provides students with foundation knowledge and other Java technologies such as Java IO, Multithreaded Programming, exception handling, Swing, JDBC, Network programming, etc.. By participating this course, students will gain hands-on experience in building a complete application at a simple/medium level by combining Java technologies learned in a systematic and methodical way.

COURSE GOALS

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

1. Practice working individually and work in collaboration with team members.
2. Explain English terminology related to the course.
3. Explain and apply basic knowledge (concept, basic syntax, data structures) in Java.
4. Explain and apply basic technologies such as Java IO, JDBC, multithreaded programming, network programming etc.
5. Analyze and decompose problems into tasks and implement them in the Java.
6. Use Java IDEs.
7. Practice personal skills such as being independent, confident, creative in thinking and working; have the ability to adapt to a new environment, lifelong learning.

REQUIRED AND RECOMMENDED READING

- [1] Java: The Complete Reference, 12th Edition, Herbert Schildt, 2021, McGraw-Hill Education.
- [2] Java: A Beginner's Guide, Eighth Edition, Herbert. Schildt, 2019, McGraw-Hill Education.
- [3] Mastering Java 9: Write reactive. modular. concurrent. and secure code, Dr. Edward Lavieri. Peter Verhas, 2017, Packt.

CSC13103 - Distributed Systems Development with Java

GENERAL INFORMATION

Course ID:	CSC13103
Course name (English):	Distributed Systems Development with Java
Course name (Vietnamese):	Công nghệ Java cho hệ thống phân tán
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Java Application Programming

COURSE DESCRIPTION

This course provides students with knowledge of Java technologies needed to build web systems including Servlet, Java Server Page, hibernate framework, Model-View-Controller framework, Spring framework. In addition, students are also introduced to other related Java technologies such as Javaser Faces, tapestry, struts, maven, ... The course also gives students practical experience in building a complete web application by combining Java technologies in a systematic and methodical.

COURSE GOALS

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

1. Practice working individually and collaboratively on web projects using Java.
2. List Java technologies for distributed systems.
3. Describe and apply Servlet, Java server page technology.
4. Describe and apply Hibernate framework.
5. Describe and apply Spring framework.
6. Produce a web application using Java technologies.
7. Use Java tools.

REQUIRED AND RECOMMENDED READING

- [1] Java EE 7 Tutorial, The, Volume 1 (Java Series) 5th Edition, Eric Jendrock (Author), Ricardo Cervera-Navarro (Author), Ian Evans (Author, Contributor), Kim Haase (Author, Contributor), William Markito (Author), Ricardo Cerveranavarro (Contributor),, 2014, Addison-Wesley Professional.
- [2] Spring in Action 5th Edition, Craig Walls, 2018, Manning.
- [3] <https://spring.io/>.
- [4] <https://www.oracle.com/java/technologies/java-ee-glance.html>.
- [5] https://www.tutorialspoint.com/spring_boot/spring_boot_introduction.htm.
- [6] <https://docs.oracle.com/javaee/7/tutorial/index.html>.

CSC13106 - Software Architecture

GENERAL INFORMATION

Course ID:	CSC13106
Course name (English):	Software Architecture
Course name (Vietnamese):	Kiến trúc phần mềm
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Software Engineering

COURSE DESCRIPTION

The subject provides students with the nature and meaning of software architecture in software development, as well as the general principles of the architectural design process and the evaluation factors of software architecture quality. The course content focuses on introducing a number of advanced approaches in software architecture design, including: some techniques for building a middle layer in software architecture (Middleware); software architecture for the software product line (ProductLine); Model-Driven Architecture and Service-Oriented Architecture.

COURSE GOALS

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

1. Practice actively participating in group discussions (in large groups of subjects), dividing work and coordinating work according to plans in small groups (including 2-3 students); Identify roles and responsibilities of team members.
2. Summarize specialized documents and lectures/slides/textbooks in English in analyzing and designing software architecture; explain some English terms in software architecture analysis and design; conduct presentation (in the form of a report written according to the prescribed form) and a presentation on the group's topic.
3. Practice critical thinking and holistic way of thinking when analyzing and designing software architecture.
4. Describe the meaning of software architecture, general principles in architecture analysis and design, criteria and requirements when designing and evaluating software architecture.
5. Conduct a presentation and analyze a number of solutions on technology and software architecture; analyze the advantages and limitations of a technology solution and software architecture.
6. Apply some software architectures introduced in the module to software development.
7. Propose improved solutions on available technology and software architecture for software systems.
8. Practice personal skills such as self-study, analysis and evaluation of new technology and architecture solutions.

REQUIRED AND RECOMMENDED READING

[1] Software Architecture in Practice, Len Bass, Paul Clements and Rick Kazman, 2021, Addison-Wesley.

- [2] Clean Architecture: A Craftsman's Guide to Software Structure and Design, Robert C. Martin, 2017, Pearson Professional.
- [3] Fundamentals of Software Architecture: An Engineering Approach, Neal Ford, Mark Richards, 2020, O'Reilly Media.
- [4] Microservices for the Enterprise: Designing, Developing, and Deploying, Kasun Indrasiri, Prabath Siriwardena, 2018, APRESS.

CSC13107 - Object-Oriented Design Patterns and Applications

GENERAL INFORMATION

Course ID:	CSC13107
Course name (English):	Object-Oriented Design Patterns and Applications
Course name (Vietnamese):	Mẫu thiết kế hướng đối tượng và ứng dụng
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Object-Oriented Programming

COURSE DESCRIPTION

The course is designed to provide students with object oriented design concepts, principles, patterns, and applications. Students will learn the 23 Gang of Four design patterns. Students will also learn SOLID principles of object oriented design. Through case study and project-based learning, students will apply object oriented best practice to solve design problems.

COURSE GOALS

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

1. Solve object oriented design problems by team-work.
2. Explain object oriented design terminologies and concepts.
3. Justify various design aspects and trade-off different factors that affect software quality.
4. Describe Gang of Four design patterns and their use cases.
5. Apply Gang of Four design patterns to different contexts in software design.
6. Analyze object oriented design principles behind design patterns.
7. Analyze and improve existing software designs.

REQUIRED AND RECOMMENDED READING

- [1] Design Patterns, Elements of Reusable Object-Oriented Software, Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, 1994, Addison Wesley.
- [2] Modern C++ Design: Generic Programming and Design Patterns Applied, Andrei Alexandrescu, 2001, Addison-Wesley.
- [3] Head First Design Patterns: Building Extensible and Maintainable Object-Oriented Software 2nd Edition, Eric Freeman, Elisabeth Robson, 2021, O'Reilly Media.

CSC13108 - Software Modeling

GENERAL INFORMATION

Course ID:	CSC13108
Course name (English):	Software Modeling
Course name (Vietnamese):	Mô hình hóa phần mềm
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Software Engineering

COURSE DESCRIPTION

A picture is worth a thousand words.” We could also apply this to software and software development. In this course, we will learn how to use diagrams and descriptive words to describe artifacts which are either final or intermediate work products that are produced and used during a software development project. We will see how parts of the software development process are broken and described in their relations which help us facilitate agile or enterprise software development. We will use mix methodologies (approach, process and modeling language) for different levels of abstraction and learn how to find the correct level of abstraction for a respective problem. This course is designed to expose you to several modeling languages for software-intensive systems and encourage you critically engage with them.

As software modeling plays not only an important role in the actual coding effort, we will also practice its effects in requirements engineering and testability.

Most of the course will be hands-on. Expect to write, design, discuss, and code a lot. We could apply any agile approach such as apply Scrum for our team management and use Kanban to manage our projects. We will manage our code via a git-based configuration management tool.

COURSE GOALS

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

1. Explain necessary models used for different software development methodologies (approaches, processes, modeling languages and tools).
2. Apply personal skills and teamwork skills for making artifacts which are produced and used during a software development project.
3. Recognize how information technology enables to change business process to yield business value.
4. Apply, analyze, synthesize and evaluate how parts of the software development process are broken and modeled in their relations which help us facilitate agile or enterprise software development.
5. Synthesize test case and test plan specifications.

REQUIRED AND RECOMMENDED READING

- [1] UML @ Classroom: An Introduction to Object-Oriented Modeling, Martina Seidl, Marion Scholz, Christian Huemer, and Gerti Kappel, 2015, Springer.
- [2] OOAD with UML 2 (RUP), Training materials from IBM company.

- [3] MDE training resources, Open Model CourseWare (OMCW) initiated by the ATLAS Team at National Institute for Research in Digital Science and Technology (INRIA).
- [4] UML by Example, Ghinwa Jalloul, 2004, Cambridge University Press.
- [5] The Business Analyst's Handbook, Howard Podeswa, 2009, Course Technology PTR.
- [6] Fundamentals of Business Process Management, Marlon Dumas , Marcello La Rosa , Jan Mendling , Hajo A. Reijers, 2018, Springer.
- [7] Conceptual Modeling of Information Systems, Antoni Olivé, 2007, Springer.
- [8] Software Engineering with UML, Bhuvan Unhelkar, 2017, CRC Press.

CSC13112 - User Interface Design

GENERAL INFORMATION

Course ID:	CSC13112
Course name (English):	User Interface Design
Course name (Vietnamese):	Thiết kế giao diện
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Software Engineering

COURSE DESCRIPTION

This course introduces and provides students with the basic principles, methods, processes, techniques and tools for the design of software user interfaces. The course also provides guidelines and helps students practice designing good user interfaces on desktop, Web, and mobile devices. Students will have the opportunity to apply principles, methods and tools to design of the interface of software applications. Students will also discuss and evaluate user interfaces of existing applications. Through this course, students will obtain knowledge and skills in designing good user interfaces for software applications and evaluating user interface as well as practicing teamwork skills.

COURSE GOALS

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

1. Practice working in teams to design the user interface of a software application and report results.
2. Summarize papers and materials in English related to user interface design.
3. Analyze and evaluate user interfaces of existing applications.
4. Explain the importance, basic concepts, and components of user interface.
5. Explain and apply basic principles of user interface for designing desktop, Web, and mobile applications.
6. Explain and apply processes, methods, and tools for designing user interfaces effectively.
7. Practice implementing the user interface of software applications according the design.
8. Apply programming skills to implement user interfaces of the proposed application.

REQUIRED AND RECOMMENDED READING

- [1] Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability, Steve Krug, 2014, Pearson Education.
- [2] Sketching User Experiences: Getting the Design Right and the Right Design, William Buxton, 2007, Morgan Kaufmann.

CSC13114 - Advanced Web Application Development

GENERAL INFORMATION

Course ID:	CSC13114
Course name (English):	Advanced Web Application Development
Course name (Vietnamese):	Phát triển ứng dụng web nâng cao
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Web Application Development

COURSE DESCRIPTION

The course is designed to provide students advanced knowledge in web application development. Student will learn how to build a single page application that utilize RESTful web service. After finishing the course, students have the ability to design, architect, implement, deploy and maintain a scalable web application.

COURSE GOALS

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

1. Practice working as a sole developer or in team to research and present some new software technology.
2. Explain some English term in Software Engineering.
3. Describe Web 2.0.
4. Practice implementing a Single page application with RESTful webservice by using a specific frontend web library/framework.
5. Explain and apply web scalability: Cloud computing, NOSQL,
6. Propose and apply suitable software technology to a specific software project.
7. Practice building software projects based on new software technology.

REQUIRED AND RECOMMENDED READING

- [1] The React Handbook, Flavio Copes, 2016, Flavio Copes.
- [2] Microservices Patterns - With Examples in Java, Chris Richardson, 2019, Manning Publications.
- [3] The Road to React: Your journey to master plain yet pragmatic React.js, Robin Wieruch, 2018, Independently published.
- [4] <https://reactjs.org/>.
- [5] <https://www.passportjs.org/docs/>.
- [6] <https://datatracker.ietf.org/meeting/101/materials/slides-101-edu-sesse-introduction-to-oauth-20-01.pdf>.
- [7] Learning React Native: Building Native Mobile Apps with JavaScript, Bonnie Eisenman, 2017, O'Reilly Media.
- [8] Learning React: Functional Web Development with React and Redux, Alex Banks. Eve Porcello, 2016, O'Reilly Media.

CSC13115 - Modern Software Development Technologies

GENERAL INFORMATION

Course ID:	CSC13115
Course name (English):	Modern Software Development Technologies
Course name (Vietnamese):	Các công nghệ mới trong phát triển phần mềm
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Web Application Development

COURSE DESCRIPTION

The course aims to meet the increasing demand for applying new and modern technologies such as blockchain, AI services, and cloud computing in software systems. Graduates with a major in Software Engineering need to have basic knowledge of modern technologies, access new technology trends, do in-depth research to meet society's needs, and lay the foundation for further study in specific fields.

This course introduces new technology trends in software development, providing students with foundational knowledge and experiences in building and expanding software by applying modern technologies.

Core topics of the course include building blockchain systems, building chatbots by applying AI services, handling real-time events, installing and configuring cloud infrastructure systems cloud, and interacting with the system through augmented reality.

COURSE GOALS

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

1. Practice working on an individual level and collaborate as a team to implement projects that apply new technologies in software development.
2. Explain English terms about new technology trends in software development.
3. Explain basic concepts, terms, and use cases of new technology trends in software development.
4. Apply new technologies to develop a software product.
5. Use software tools to develop applications that use new technologies.

REQUIRED AND RECOMMENDED READING

[1] Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications, Lorne Lantz, Daniel Cawrey, 2020, O'Reilly Media.

[2] Applied Deep Learning with Python: Use scikit-learn, TensorFlow, and Keras to create intelligent systems and machine learning solutions, Alex Galea , Luis Capelo, 2018, Packt Publishing.

CSC13116 - Software Engineering Capstone

GENERAL INFORMATION

Course ID:	CSC13116
Course name (English):	Software Engineering Capstone
Course name (Vietnamese):	Đồ án Công nghệ phần mềm
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Software Engineering

COURSE DESCRIPTION

The number of students graduating with high scores but not finding jobs is increasing. One of the reasons is their lack of experience. They can only leverage their knowledge and skills in a discrete manner. They cannot synthesize them together in order to solve real world problems. In addition, students also find it difficult to learn domain knowledge, or familiarize themselves with a new tool, technique, or method to complete a real world project.

The software engineering capstone course integrates all the knowledge and skills students have learned, aiming to help them work as a team to identify a problem; elicit, analyze and manage requirements; design, implement and test a solution; perform quality assurance, project management; create documentation and deliver a result that is equivalent to commercial software. A differentiator of this course is that the problem to be solved must be a real world problem, the solution must be experienced and discovered by students themselves, based on all the knowledge they have learned, and additional knowledge that they need to acquire by themselves in order to support solving the problem when their existing knowledge is not enough. This situation is similar to working in a company or an organization. Each team member can themselves take on the role of a full stack developer.

The content of this course focuses on application of methods of problem definition, requirements elicitation and analysis, prototyping, proof-of-concept creation, software design, software construction, and software testing; application of Kanban method; application of project management techniques (including estimation, schedule or release plan creation); introducing quality measures; testing and applying new tools and technologies.

In addition, some popular technical background and topics in the software industry directly related to capstone projects can also be introduced to help students develop their independent learning ability and research skill, including method for learning a programming language, a technology, an application framework, a software architecture (for example microservice architecture, event sourcing, command and query responsibility segregation (CQRS) technique, application framework architecture), domain-driven design, test-driven development, complex system source code reading method, test automation, system optimization, system refactoring, software security, software configuration, software customization, game development, machine learning development, natural language processing development, computer vision development, and blockchain development.

COURSE GOALS

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

1. Identify a real world problem, analyze business requirements, propose a solution using software; and analyze the effects of the solution on individuals, organization and society.
2. Select and document a software development method, create a project plan, execute, monitor, control project development and create project status reports.
3. Analyze, design, implement, test, deploy, operate and document the proposed solution.
4. Evaluate results of the proposed solution; compare the proposed solution with alternatives.
5. Practice learning new tools, programming languages, technologies and methods by themselves to implement the proposed solution.
6. Practice engineering 75,000 lines of code software with a team of 10 people.
7. Explain responsibilities and ethics when undertaking a software project.

REQUIRED AND RECOMMENDED READING

[1] Engineering Software Products: An Introduction to Modern Software Engineering, Ian Sommerville, 2021, Pearson.

CSC13117 - Advanced Game Development

GENERAL INFORMATION

Course ID:	CSC13117
Course name (English):	Advanced Game Development
Course name (Vietnamese):	Phát triển game nâng cao
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Game Development

COURSE DESCRIPTION

The course is designed to provide students with the knowledge and skills needed in 3D game development. The course content provides an overview of the techniques and components in 3D game development, and focuses on graphics techniques, lighting, animation and effects in 3D environment. With this course, students will know how to build interactive, audio and pathfinding systems, network protocols in the game, specify and handle scenarios and in-game event systems. Students also will know how to build an AR/VR game and produce performance-optimized for mobile applications.

COURSE GOALS

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

1. Practice group discussions actively (in groups of subjects) and working in group according to plans in small groups (including 2-3 students); Explain the roles and responsibilities of team members.
2. Summarize specialized documents in English on the analysis and software design and the technologies used; explain some English terms in software analysis and design; write reports (according to provided template) and conduct a presentation the group's project topic.
3. Conduct a presentation an overview of the essential components in 3D game.
4. Apply knowledge, skills, methods, tools and technologies to build components in 3D game (visual scripting, lighting, meshes, map, skypebox, sound...).
5. Explain and practice building a complete 3D game with networking, artificial intelligence, AR/VR.
6. Apply methods, tools and technologies in optimization for mobile games.
7. Explain the responsibility of game developers and the impact of games on society; Express consciously always learning to use other programming languages and game engines to develop games.

REQUIRED AND RECOMMENDED READING

- [1] 3D Game Development with Unity 2022, Franz Lanzinger, 2022, CRC Press.
- [2] Game Development Patterns and Best Practices: Better games, Less hassle, John P. Doran. Matt Casanova, 2017, Packt.
- [3] Video Game Level Design: How to Create Video Games with Emotion, Interaction, and Engagement, Michael Salmond, 2021, Bloomsbury Academic.

CSC13118 - Advanced Mobile Application Development

GENERAL INFORMATION

Course ID:	CSC13118
Course name (English):	Advanced Mobile Application Development
Course name (Vietnamese):	Phát triển ứng dụng cho thiết bị di động nâng cao
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Mobile Application Development

COURSE DESCRIPTION

The course is designed to provide students advanced knowledge in mobile application development. Students will learn how to build a mobile application that uses a cross-platform framework (React Native or Flutter). After finishing the course, students have the ability to design, architect, implement, deploy and maintain a mobile application with a modern cross-platform framework.

COURSE GOALS

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

1. Practice working as a sole developer or in team to research and present some new software technology.
2. Explain some English terms in Software Engineering.
3. Conduct a presentation about developing mobile applications with cross-platform framework.
4. Practice implementing a mobile application with RESTful web service by using a cross-platform (React Native, Flutter) library/framework.
5. Design the front-end architecture for a medium/big mobile application.
6. Propose and apply suitable software technology to a specific software project.
7. Practice building software projects based on new software technology.

REQUIRED AND RECOMMENDED READING

- [1] Flutter Complete Reference: Create beautiful, fast and native apps for any device, Alberto Miola, 2020, Amazon.
- [2] Programming Flutter: Native, Cross-Platform Apps the Easy Way (The Pragmatic Programmers), Carmine Zaccagnino, 2020, Pragmatic Bookshelf.
- [3] <https://docs.flutter.dev/>.
- [4] <https://reactnative.dev/docs/getting-started>.

CSC14001 - Automata and Formal Languages

GENERAL INFORMATION

Course ID:	CSC14001
Course name (English):	Automata and Formal Languages
Course name (Vietnamese):	Automata và ngôn ngữ hình thức
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Data Structures and Algorithms

COURSE DESCRIPTION

This course provides a challenging introduction to some of the central ideas of theoretical computer science. The course formalizes the notion of computation, using 3 models of computation of increasing power: finite automata, push down automata, and Turing machines - a kind of automaton that can define all the languages that can reasonably be said to be definable by any sort of computing device. The course also explains the relationship between these models and different classes of languages: regular, context-free, recursive and recursively enumerable. These concepts form the core of natural language processing, compiler design, speech recognition, theory of programming languages, ...

COURSE GOALS

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

1. Analyze and propose reasonable solutions to problems in computer science.
2. Interpret English terminology in the theory of computer science.
3. Explain the nature, role, and operation of computational structures and their variants.
4. Analyze the properties of classes of formal languages.
5. Construct automata recognizing each class of formal languages.
6. Construct formal grammars generating each class of formal languages.

REQUIRED AND RECOMMENDED READING

[1] Lý thuyết ngôn ngữ hình thức, Nguyễn Thanh Phương, 2018, NXB Khoa học và Kỹ thuật.

CSC14002 - Knowledge-Based Systems

GENERAL INFORMATION

Course ID:	CSC14002
Course name (English):	Knowledge-Based Systems
Course name (Vietnamese):	Các hệ cơ sở tri thức
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Fundamentals of Artificial Intelligence

COURSE DESCRIPTION

The course aims to equip students with: A comprehensive understanding of Knowledge Management (KM), encompassing the fundamentals of KM, the implementation of KM practices, and the importance of learning from experience; Extensive knowledge of various interconnected subjects, such as models for representing knowledge, Fuzzy logic, project management for Knowledge-based systems (KBS), neural networks, Genetic algorithms, and other relevant topics; Adequate theoretical grounding in the conceptual underpinnings of Knowledge-based systems stages, and the ability to implement these systems through computer applications.

COURSE GOALS

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

1. Discuss about Knowledge management and its broad applications in various aspects of our day-to-day life.
2. Operate the algorithms used in various phases of Knowledge-based systems, including Knowledge management process and Knowledge Works Systems (KWS).
3. Employ the techniques used in Knowledge-based systems, such as representation of knowledge (knowledge base), reasoning processes (inference/reasoning), neural networks, Fuzzy logic, genetic algorithms, etc.
4. Summarize knowledge of various applications of Knowledge-based systems in real life, including reading research papers and preparing presentations.
5. Produce programs for Knowledge-based systems and implement the various techniques discussed throughout the course.

REQUIRED AND RECOMMENDED READING

- [1] Knowledge Based System A Complete Guide, Gerardus Blokdyk, 2020, 5STARCOOKS.
- [2] Knowledge-Based Systems, Rajendra Akerkar, Priti Sajja, 2009, Jones & Bartlett Learning.

CSC14004 - Data Mining and Applications

GENERAL INFORMATION

Course ID:	CSC14004
Course name (English):	Data Mining and Applications
Course name (Vietnamese):	Khai thác dữ liệu và ứng dụng
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Data Structures and Algorithms

COURSE DESCRIPTION

The course is designed to provide students with the basics of the field of Data Mining and its applications to other sciences. This course covers general contents related to the process of discovering knowledge from data and the insights related to common techniques in data mining such as common set mining and conclusions. knowledge assembly, classification, clustering and evaluation.

COURSE GOALS

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

1. Show ability to work at an individual and team level to present a sample of scientific reports and present subject-related content.
2. Explain English terms in the field of data mining.
3. Explain basic concepts and terminology in the field of data mining.
4. Express the meaning and application of data mining problems in real-world problems.
5. Explain how basic algorithms work in data mining.
6. Conduct some components of a small-scale data mining system.
7. Use software tools.

REQUIRED AND RECOMMENDED READING

- [1] Data Mining Concepts and Techniques 4th Edition, Jiawei Han, Jian Pei, Hanghang Tong, 2022, The Morgan Kaufmann Series.
- [2] Data Mining and Machine Learning: Fundamental Concepts and Algorithms (2nd edition), Mohammed J. Zaki and Wagner Meira, Jr, 2020, Cambridge University Press.
- [3] Introduction to Data Mining, 2nd Edition, Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar, 2019, Pearson.

CSC14005 - Introduction to Machine Learning

GENERAL INFORMATION

Course ID:	CSC14005
Course name (English):	Introduction to Machine Learning
Course name (Vietnamese):	Nhập môn học máy
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Fundamentals of Artificial Intelligence

COURSE DESCRIPTION

The course is designed to provide students with a foundational knowledge of the field of machine learning. The main content would answers the questions: What is machine learning? Can the machine learn or not? How can the machine learn? How can the machine learn well? In practice, students will learn a high-level programming language such as Python to design, implement and deploy learning models easily and quickly.

COURSE GOALS

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

1. Explain the concept of machine learning.
2. Explain the reason why machines can learn.
3. Produce learning models using high-level languages such as Python or MATLAB.
4. Analyze and evaluate results when applying a specific machine learning model to a particular dataset, then propose solutions for improvement.
5. Use technical documents related to machine learning in English.

REQUIRED AND RECOMMENDED READING

[1] Introduction to Machine Learning, Ethem Alpaydin, 2020, MIT Press.

[2] Mathematics For Machine Learning, Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, 2020, Cambridge University Press.

CSC14006 - Pattern Recognition

GENERAL INFORMATION

Course ID:	CSC14006
Course name (English):	Pattern Recognition
Course name (Vietnamese):	Nhận dạng
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Fundamentals of Artificial Intelligence

COURSE DESCRIPTION

The course aims to offer students: foundational understanding of pattern recognition, including the principles and techniques employed in computer-based pattern recognition systems; comprehensive knowledge of various interconnected subjects within the field, such as pattern recognition systems, preprocessing and feature extraction methods, theories of supervised and unsupervised learning, object classification and recognition techniques, deep neural networks, and other relevant topics; adequate theoretical background in the conceptual aspects of pattern recognition systems, enabling students to comprehend the stages involved. Furthermore, students will gain practical experience in implementing these systems through computer applications. By the end of the course, students will have acquired a solid foundation in pattern recognition, a broad understanding of related topics, and the ability to apply theoretical concepts to real-world scenarios by developing pattern recognition systems using computer applications.

COURSE GOALS

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

1. Describe about pattern recognition and its broad applications in various aspects of our day-to-day life.
2. Explain the algorithms used in different phases of pattern recognition systems, including data acquisition, pre-processing, segmentation, feature extraction, and classification.
3. Demonstrate the techniques used to recognize patterns, such as statistical approaches, data clustering, neural networks, etc.
4. Summarize knowledge of various applications of pattern recognition in real life, including reading research papers and preparing presentations.
5. Produce pattern recognition programs and implement various techniques discussed throughout the course.

REQUIRED AND RECOMMENDED READING

- [1] Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, 2016, The MIT Press.
- [2] Pattern Recognition, Sergios Theodoridis, Konstantinos Koutroumbas, 2008, Academic Press; 4th edition.

CSC14007 - Introduction to Algorithm Complexity Analysis

GENERAL INFORMATION

Course ID:	CSC14007
Course name (English):	Introduction to Algorithm Complexity Analysis
Course name (Vietnamese):	Nhập môn phân tích độ phức tạp thuật toán
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Programming Techniques, Data Structures and Algorithms

COURSE DESCRIPTION

The course provides students with the foundational knowledge and basic techniques for analyzing the complexity of algorithms. The course content includes fundamental concepts of computational complexity, and mathematical tools such as sum calculus, counting, probability theory, permutations, generating functions. These tools are applied to analyze algorithm complexity, to investigate theoretically and practically the complexity of common and useful algorithms.

COURSE GOALS

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

1. Describe how to study and present assignments related to topics of algorithmic complexity.
2. Explain basic English terms related to algorithmic complexity.
3. Apply mathematical tools to analyze the complexity of several algorithms and classify them according to their complexity.
4. Breakdown algorithms to identify components that affect their complexity.
5. Analyze the complexity of simple algorithms based on segmentation techniques, counting, and summation techniques.
6. Apply probability theory to analyze the complexity of algorithms.
7. Apply generating function to analyze the complexity of common algorithms.
8. Apply permutations to analyze the complexity of common algorithms.

REQUIRED AND RECOMMENDED READING

- [1] Computer Science, Algorithms and Complexity, Adele Kuzmiakova, 2020, Arcler Press.
- [2] The Art of Computer Programming, Donald Knuth, 1997, Addison-Wesley.

CSC14008 - Scientific Research Methodology

GENERAL INFORMATION

Course ID:	CSC14008
Course name (English):	Scientific Research Methodology
Course name (Vietnamese):	Phương pháp nghiên cứu khoa học
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course aims to offer students the knowledge and skills:

(1) Understanding of Research Methods: Students will gain knowledge of various research methodologies and techniques used in academic and scientific investigations. This includes qualitative and quantitative research methods, data collection and analysis techniques, and ethical considerations in research.

(2) Research Project Selection and Proposal Drafting: Students will learn how to choose a research project based on their area of interest and expertise. They will also develop skills in drafting a research proposal, including formulating research questions, defining objectives, designing methodologies, and outlining expected outcomes.

(3) Project Planning and Risk Management: Students will acquire skills in project planning, including creating work breakdown structures, setting milestones, estimating resources, and scheduling tasks.

(4) Scientific Document Preparation: Students will learn the methods and conventions of preparing scientific documents, such as research papers, conference presentations, and technical reports. This includes structuring documents, citing sources, and adhering to academic writing standards.

(5) Project Development and Reporting: Students will gain knowledge of software development methods applicable to research projects. They will learn to monitor project progress, write detailed project reports, and effectively present their findings to different audiences, such as academic peers or industry stakeholders.

By the end of the course, students will possess the necessary skills to conduct research effectively. They will be equipped with the knowledge of research methods, project planning and risk management, scientific document preparation, and project development and reporting, enabling them to undertake research projects successfully and communicate their findings professionally.

COURSE GOALS

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

1. Discuss about research methods and their broad applications in various aspects of our day-to-day life.
2. Explain the methods of choosing a research project and drafting research proposals.
3. Conduct project planning and risk management.
4. Prepare scientific documents, including reading research papers.
5. Operate software development methods for the project and monitor the progress of project implementation, including preparing writing and presentations by the students.

REQUIRED AND RECOMMENDED READING

[1] Introduction to Research: Understanding and Applying Multiple Strategies, Elizabeth DePoy PhD MSW OTR, Laura N. Gitlin PhD. FGSA FAAN, 2019, Mosby.

[2] Introduction to Research Methods, Robert B Burns, 2000, SAGE Publications Ltd.

CSC14101 - Data Hiding and Steganography

GENERAL INFORMATION

Course ID:	CSC14101
Course name (English):	Data Hiding and Steganography
Course name (Vietnamese):	Ẩn dữ liệu và chia sẻ thông tin
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Data Structures and Algorithms

COURSE DESCRIPTION

This course provides basic concepts and techniques related to the process of securing multimedia information. Students are provided the ability to analyze and evaluate the characteristics of a system of hiding data and sharing confidential information. Based on the characteristics and structure of each type of information and the unique requirements of each system, students can build appropriate data sharing and protection models themselves. In addition, the course also helps students have the right attitude, opinion and awareness about the importance of data and the sense of protecting important data. Moreover, after this course students have the ability to create their own security system and share private data.

COURSE GOALS

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

1. Explain English terms, writing, and presentation skills related to the field of Data Hiding and Secret Sharing.
2. Apply knowledge of math, physics, and programming.
3. Explain basic concepts, terms, and issues related to data hiding, including watermarking (digital watermarking), steganography (secret communication), applications of the field, and models for sharing confidential information.
4. Apply appropriate data hiding techniques to given requirements of real problems.
5. Construct the appropriate data sharing and security models based on the structure of each type of information and the unique requirements of each system.
6. Operate the copyright of intellectual products.
7. Analyze and/or aggregate documents and write scientific reports.

REQUIRED AND RECOMMENDED READING

- [1] Data Hiding and Its Applications: Digital Watermarking and Steganography, David Meg'ias, Wojciech Mazurczyk, Minoru Kuribayashi, 2022, Mdpi AG.
- [2] Ẩn dữ liệu và chia sẻ thông tin, Lê Hoài Bắc, Lê Thị Hoàng Ngân, 2011, ĐHQG HCM.

CSC14105 - Web Science

GENERAL INFORMATION

Course ID:	CSC14105
Course name (English):	Web Science
Course name (Vietnamese):	Khoa học về web
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course will introduce the definition of Web generations and future Web trends. Students are provided the concepts on the mathematical aspect - graph theory, on the social aspect. Moreover, students will also be provided with knowledge about problems related to the Web such as: Web crawler, Web search, etc. In addition, the course also deals with difficult problems that the Web generations are facing and to set the trend for the future of the Web.

COURSE GOALS

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

1. Discuss the three generations of the Web: Web 1.0, Web 2.0, and Web 3.0.
2. Express important Web applications.
3. Analyze how technical changes affect the social aspects of Web-based computing.
4. Express modern Web development.
5. Develop programs related to Web applications by aggregating knowledge.

REQUIRED AND RECOMMENDED READING

[1] Web Data Mining, Bing Liu, 2011, Springer.

[2] Mining the Social Web, 3rd Edition, Matthew A. Russell, Mikhail Klassen, 2018, O'Reilly Media, Inc.

CSC14109 - Fuzzy Logic and Applications

GENERAL INFORMATION

Course ID:	CSC14109
Course name (English):	Fuzzy Logic and Applications
Course name (Vietnamese):	Logic mờ và ứng dụng
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Data Structures and Algorithms

COURSE DESCRIPTION

The course aims to provide students with the following knowledge and skills:

(1) Comprehensive Understanding of Fuzzy Set Theory: Students will acquire knowledge of fuzzy set concepts, fuzzy logic principles, fuzzy relationships, and fuzzy numbers. They will grasp the foundations of fuzzy set theory, from basic concepts to more advanced topics.

(2) Methods for Solving Basic Problems on Fuzzy Numbers: Students will learn techniques for solving problems involving fuzzy numbers. This includes solving first-order fuzzy number equations and quadratic fuzzy equations, enabling them to handle mathematical operations with fuzzy numbers.

(3) Steps for Building a Fuzzy System: Students will understand the necessary steps involved in constructing a fuzzy system. They will learn how to define membership functions for discrete variables and continuous variable spaces. Additionally, they will gain insights into handling fuzzy problems and making appropriate fuzzy-based decisions.

(4) Application of Fuzzy Logic Controller: Students will explore the practical application of fuzzy logic controllers. They will examine a real-world example, such as the simulation of unmanned helicopter control using a fuzzy logic controller. This will provide them with hands-on experience in applying fuzzy logic principles to control systems.

(5) Design and Implementation of a Fuzzy System: Students will acquire the skills to design and build a fuzzy system for a simple application problem. They will understand the process of defining membership functions, developing fuzzy rules, and implementing the fuzzy system to solve real-world problems.

By the end of the course, students will have a solid understanding of fuzzy set theory, the ability to solve problems involving fuzzy numbers, and the skills to design and implement fuzzy systems for practical applications. They will be prepared to apply fuzzy logic principles to various domains and develop fuzzy-based solutions to complex problems.

COURSE GOALS

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

1. Discuss about fuzzy set theory and its broad applications in various aspects of our day to day life.
2. Solve basic problems on fuzzy numbers by understanding the methods, including solving first-order fuzzy number equations and solving quadratic fuzzy equations.

3. Report a fuzzy system by understanding the necessary steps, including membership function for discrete variables, membership function for space of continuous variables, and fuzzy problem handling.
4. Apply fuzzy logic controller for a real application example by reading research papers and preparing presentations.
5. Design and build a fuzzy system for solving a simple application problem.

REQUIRED AND RECOMMENDED READING

- [1] Fuzzy Logic, Systems and Engineering Applications, Hubert Parks, 2022, Murphy & Moore Publishing.
- [2] Fuzzy Logic with Engineering Applications, Timothy J. Ross, 2010, WILEY.

CSC14111 - Introduction to Design and Analysis of Algorithms

GENERAL INFORMATION

Course ID:	CSC14111
Course name (English):	Introduction to Design and Analysis of Algorithms
Course name (Vietnamese):	Nhập môn thiết kế và phân tích giải thuật
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

Algorithm design and analysis are the theoretical backbone of computer science. Designing efficient algorithms under different resource constraint is a ubiquitous problem. This course presents major principles of algorithm design and analysis, and applies those principles to classical problems in computer science. Topics include algorithm complexity analysis, greedy algorithms, divide and conquer algorithms, dynamic programming, backtracking algorithms, ...

COURSE GOALS

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

1. Propose solutions to problems by thinking independently.
2. Interpret English terminology in the field of algorithm design and analysis.
3. Evaluate the complexity of algorithms by applying methods.
4. Compare and apply major algorithm design techniques by analyzing them.
5. Solve classes of problems commonly encountered in computer science by analyzing them.

REQUIRED AND RECOMMENDED READING

[1] Introduction to the Design and Analysis of Algorithms (3rd edition), Anany Levitin, 2012, Pearson.

CSC14112 - Biometrics

GENERAL INFORMATION

Course ID:	CSC14112
Course name (English):	Biometrics
Course name (Vietnamese):	Sinh trắc học
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Fundamentals of Artificial Intelligence

COURSE DESCRIPTION

The course aims at providing students knowledge and skills related to biometrics. Students will develop a solid understanding of the various phases involved in biometric systems for identification and verification tasks. They will learn about the stages of data acquisition, preprocessing, feature extraction, matching algorithms, and decision-making processes within biometric systems. They also gain the skills to assess the strengths and weaknesses of different biometric modalities using quantitative and qualitative evaluation measures. They will explore error metrics, usability factors, and public perception to critically analyze and compare various biometric technologies, including emerging ones. Moreover, they will acquire a sufficient theoretical background in the key concepts underlying face recognition systems. They will delve into the stages of face recognition, including face detection, feature extraction, and matching algorithms. Moreover, students will gain practical experience by implementing face recognition systems using computer applications. By the end of the course, students will possess the necessary knowledge to comprehend the phases of biometric systems, evaluate biometric modalities using appropriate metrics, and implement face recognition systems. They will be equipped to analyze the strengths and limitations of biometric technologies and apply their skills to emerging advancements in the field.

COURSE GOALS

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

1. Discuss about the broad applications of biometrics in various aspects of our day to day life.
2. Perform identification and verification tasks in biometric systems by understanding the techniques used in various phases.
3. Recognize face using algorithms such as AdaBoost, ASM, deep neural networks, etc., by understanding them.
4. Explore various applications of biometrics in real life by reading research papers and preparing presentations.
5. Construct biometric programs by using the various techniques discussed throughout the course.

REQUIRED AND RECOMMENDED READING

- [1] Machine Learning for Biometrics: Concepts, Algorithms and Applications, Partha Pratim Sarangi, Madhumita Panda, Subhashree Mishra, 2022, Academic Press.
- [2] Biometrics: Theory, Methods, and Applications, N. V. Boulgouris, Konstantinos N. Plataniotis, Evangelia Micheli-Tzanakou, 2009, John Wiley & Sons.

CSC14113 - Compiler

GENERAL INFORMATION

Course ID:	CSC14113
Course name (English):	Compiler
Course name (Vietnamese):	Trình biên dịch
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Automata and Formal Languages

COURSE DESCRIPTION

The course covers the design of compilers, which translate source code written in a high-level programming language into the machine language that is executed by computer hardware. The compiler, along with the operating system, is one of the central pieces of systems software that makes computers usable.

This course will discuss the major ideas used in the implementation of compilers, including lexical analysis, syntax analysis, semantic analysis, syntax-directed translation, abstract syntax trees, symbol table generation, intermediate code and intermediate code generation, code generation, and runtime systems. As part of the course, students will write a small compiler for a C-like language.

COURSE GOALS

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

1. Discuss the role and organization of a programming language implementation system.
2. Interpret English terminology in the field of compiler design and construction.
3. Explain the role of Runtime environment.
4. Explain the role, design, and operation of the Front-end phase.
5. Explain the role, design, and operation of the Back-end phase.

REQUIRED AND RECOMMENDED READING

[1] Compilers: Principles, Techniques, and Tools, A. Aho, M. Lam, R. Sethi, J. Ullman, 2006, Addison Wesley.

CSC14118 - Introduction to Big Data

GENERAL INFORMATION

Course ID:	CSC14118
Course name (English):	Introduction to Big Data
Course name (Vietnamese):	Nhập môn dữ liệu lớn
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Databases

COURSE DESCRIPTION

The course is designed to provide students fundamental knowledge of Big Data, including the principle of Big Data, the needs and benefits of large-scale data analytics in modern life, and the manipulation of widely known Big Data tools. Large-scale data has unique characteristics that requires scaling up analytical technologies and algorithms, and thus leading to new perspectives in data understanding and data analysis.

Students are provided an overview of the actively growing field of Big Data, its key issues in data management and associated applications in intelligent business and scientific studies. Their practical experiences will be strengthened through the manipulation of the tools for managing and analyzing Big Data like Hadoop MapReduce for batch processing, Spark for streaming processing and NoSQL databases. Those enables students to build their own skills to solve complex real-world problems in for decision support.

COURSE GOALS

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

1. Discuss the key principles of Big Data and motivation for moving from classical data analysis to more advanced forms.
2. Acquire fundamental enabling techniques and scalable algorithms like Hadoop Map Reduce, Spark and NoSQL for large-scale data analytics.
3. Describe adequate perspectives of Big Data analytics by introducing various tools for large-scale data analytics and applying Big Data in various applications.
4. Select and implement machine learning/data analytics techniques and computing environments suitable for the applications under consideration.
5. Investigate designated online courses about some Big Data topics and complete most learning items in that course.

REQUIRED AND RECOMMENDED READING

- [1] Hadoop: The Definitive Guide (4th edition), Tom White, 2015, O'Reilly Media.
- [2] Learning Spark: Lightning-Fast Data Analytics 2nd Edition, Jules Damji, Brooke Wenig, Tathagata Das, Denny Lee, 2020, O'Reilly Media.
- [3] Spark: The Definitive Guide: Big Data Processing Made Simple, Bill Chambers and Matei Zaharia, 2018, O'Reilly Media.

CSC14114 - Applications of Big Data

GENERAL INFORMATION

Course ID:	CSC14114
Course name (English):	Applications of Big Data
Course name (Vietnamese):	Ứng dụng dữ liệu lớn
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Big Data

COURSE DESCRIPTION

The course is designed to provide students essential knowledge when applying Big Data to practical and interdisciplinary problems, including recommender system and graph mining. Students will spend hours to consider each problem from multiple perspectives. First, they are guided to approach the problem by considering its formal problem definition and a brief literature review. Second, students examines the characteristics of data as well as how to manipulate them simply. And finally, students work in group to implement a practical system on examined data.

COURSE GOALS

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

1. Describe the needs and benefits of applying Big Data techniques to practical systems that deal with massive data.
2. Review literature to understand the problems of recommender system (RS) and graph mining (GM) in terms of problem definition.
3. Conduct recommender systems and perform graph analysis on available massive datasets using Spark MLlib and Google Collab.
4. Examine suitable machine learning/data analytics techniques and computing environments for the applications under consideration and implement them.

REQUIRED AND RECOMMENDED READING

- [1] Sentiment Analysis: Mining Opinions, Sentiments, and Emotions (Studies in Natural Language Processing) 2nd Edition, Bing Liu, 2020, Cambridge University Press.
- [2] Mining of Massive Datasets 3rd Edition, Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, 2020, Cambridge University Press.

CSC14119 - Introduction to Data Science

GENERAL INFORMATION

Course ID:	CSC14119
Course name (English):	Introduction to Data Science
Course name (Vietnamese):	Nhập môn khoa học dữ liệu
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Data Structures and Algorithms

COURSE DESCRIPTION

This course provides students with the basics of the data science process, including asking questions to answer (with data), automatically collecting data from the web, preprocessing data, analyzing/modeling the data using Machine Learning (the output of this step is the answer to the original question), and communicate the results effectively. In addition, the course focuses a lot on practice on real data sets with the programming language in Python - a language commonly used today in the field of data science.

COURSE GOALS

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

1. Apply teamwork skills to investigate a specific problem in data science.
2. Explain the English terms used in the field of data science.
3. Explain methods for collecting data from the web.
4. Describe the statistical values of centrality and distribution of each component, sampling method, and research design.
5. Construct a suitable approach to visualize and preprocess data for a given problem.
6. Apply machine learning models and analyze the archived results.
7. Summarize the whole process of data science and the methods to communicate results.

REQUIRED AND RECOMMENDED READING

[1] The Data Science Handbook: Advice and Insights from 25 Amazing Data Scientists, Carl Shan, William Chen, Henry Wang, Max Song, 2021, Richard Hurley.

[2] Analytics, Data Science, & Artificial Intelligence: Systems for Decision Support, Ramesh Sharda, Dursun Delen, Efraim Turban, 2019, Pearson.

CSC14115 - Applied Data Science

GENERAL INFORMATION

Course ID:	CSC14115
Course name (English):	Applied Data Science
Course name (Vietnamese):	Khoa học dữ liệu ứng dụng
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Data Science

COURSE DESCRIPTION

This course is a subsequent course of Introduction to Data Science. Introduction to Data Science course provides students with Python programming, data science tools, and processes with relatively simple methods. This course explores the case studies of the application of data science. Thereby, students will be introduced to a wide range of practical applications of data science, learning more methods of data collection, preprocessing, and data analysis (besides methods in the Data Science course). Students can apply these methods to create a new application by themselves. In addition, the course provides the necessary ethical principles when developing data science applications.

COURSE GOALS

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

1. Describe case studies on the application of data science.
2. Construct data collection methods and preprocessing methods.
3. Practice data processing methods and evaluate the results.
4. Plan suggestions for improvement based on the evaluation results.
5. Explain the results of data analysis clearly and effectively by using presentation skills.
6. Explain the importance of ethical issues when building data science applications.

REQUIRED AND RECOMMENDED READING

[1] Applied Data Science Using PySpark: Learn the End-to-End Predictive Model-Building Cycle, Ramcharan Kakarla, Sundar Krishnan, 2020, Apress.

[2] Applied Data Science with Python and Jupyter: Use powerful industry-standard tools to unlock new, actionable insights from your data, Alex Galea, 2018, Packt Publishing.

CSC14116 - Applied Parallel Programming

GENERAL INFORMATION

Course ID:	CSC14116
Course name (English):	Applied Parallel Programming
Course name (Vietnamese):	Lập trình song song ứng dụng
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Parallel Programming

COURSE DESCRIPTION

This course is the continuation of “Parallel Programming” course and is a project-based course (it’s possible for students who have not taken “Parallel Programming” course before to take this course but students will need to study by themselves materials of “Parallel Programming” course). In the project of this course, students will parallelize and optimize an real-world application to make it run faster. Through this project, student will learn the process of parallelizing/optimizing a program to speed it up: analyze the current implementation to identify hotspots, design the way to parallelize/optimize these hotspots, implement the design, evaluate the correctness and speed of the new implementation, repeat. We will focus on parallel programming on GPU (Graphics Processing Units, students will use free GPUs in Google Colab) with CUDA Python (which allows us to implement more quickly than CUDA C/C++). This course is also a chance to reflect and practice important skills such as: writing/speaking (about your project), criticizing (about your friends’ projects), teamwork (if the project is done in teams).

COURSE GOALS

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

1. Generate the sequential version of the application in the project by applying design-implement-evaluate.
2. Generate the parallel version of the application in the project by applying analyze-design-implement-evaluate.
3. Generate the optimized parallel version of the application in the project by applying analyze-design-implement-evaluate.
4. Explain about the project to Teacher and friends by using writing/speaking skills.
5. Provide helpful feedback about friends’ projects by applying criticizing skills.
6. Construct team and assign tasks based on teamwork skills.

REQUIRED AND RECOMMENDED READING

[1] Programming Massively Parallel Processors: A Hands-on Approach 4th Edition, Wen-mei W. Hwu, David Kirk, Izzat El Hajj, 2022, Morgan Kaufmann.

CSC14117 - Introduction to IoT Programming

GENERAL INFORMATION

Course ID:	CSC14117
Course name (English):	Introduction to IoT Programming
Course name (Vietnamese):	Nhập môn lập trình kết nối vạn vật
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Programming Techniques

COURSE DESCRIPTION

The course will provide students with the basic knowledge to build an IoT system. Essential knowledge includes (A) basic hardware design for reading data from sensors and control peripheral devices; (B) programming on embedded devices like Arduino, ESP32, Raspberry Pi; (C) wired and wireless communication between devices using TTL, I2C, SPI, Bluetooth, wifi, ...; (D) techniques for connecting and storing data to the server; (E) techniques for connecting to mobile phones. Students will have practical experiences building a complete simple IoT system systematically and methodically. This knowledge is the foundation for students to participate in digital transformation projects in the future.

COURSE GOALS

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

1. Interpret the roles of individuals and groups in response to earning requirements.
2. Interpret concepts and terms in the field of Internet of Thing (IoT).
3. Operate the fundamental platforms and devices of IoT.
4. Practice embedded programming on the Arduino and ESP32 platforms.
5. Build a simple IoT system.
6. Recognize the roles and applications of IoT in academic and industry context.

REQUIRED AND RECOMMENDED READING

[1] Internet of Things and its Applications: Made simple, Satish Jain, Shashi Singh, 2020, BPB Publications.

CSC14120 - Parallel Programming

GENERAL INFORMATION

Course ID:	CSC14120
Course name (English):	Parallel Programming
Course name (Vietnamese):	Lập trình song song
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Programming Techniques

COURSE DESCRIPTION

The course is designed to provide students with knowledge and skills of parallel programming on GPU (Graphics Processing Units, students will use free GPUs in Google Colab) with CUDA C/C++ (or CUDA for short); through this, students will develop a mindset of general parallel programming and will be able to quickly learn parallel programming on other hardware and programming languages. Concretely, students will learn about the differences between CPU and GPU, and how to write CUDA programs to take advantage of both CPU and GPU: sequential parts will run on CPU, massively parallel parts will run on GPU. Students will learn how to divide work for threads on GPU and coordinate these threads so that they will run in parallel and not interfere with each other. Students will also learn about optimization techniques to speed up CUDA programs further. Finally, student will be able to apply their learned knowledge and skills to parallelize and optimize an application which is slow if implemented sequentially.

COURSE GOALS

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

1. Operate common tasks (vector addition, matrix multiplication, convolution, reduction, scan, histogram, sort, ...) for parallel execution on the GPU using CUDA.
2. Apply the knowledge of GPU parallel execution in CUDA to speed up a CUDA program.
3. Apply the knowledge of GPU memories in CUDA to speed up a CUDA program.
4. Apply the optimization process to optimize a CUDA program.
5. Apply teamwork skills to complete the final project.

REQUIRED AND RECOMMENDED READING

[1] Programming in Parallel with CUDA: A Practical Guide, Richard Ansoerge, 2022, Cambridge University Press.

[2] Nhập môn CUDA, Lê Hoài Bắc, Phạm Hoài Vũ, 2012, ĐHQG HCM.

[3] Lập Trình Song Song Trên GPU, Lê Hoài Bắc, Vũ Thanh Hưng, Trần Trung Kiên, 2015, Nhà xuất bản Khoa học và kỹ thuật.

CSC15001 - Computer Security

GENERAL INFORMATION

Course ID:	CSC15001
Course name (English):	Computer Security
Course name (Vietnamese):	An ninh máy tính
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Data Structures and Algorithms, Introduction to Databases

COURSE DESCRIPTION

The course is designed to provide students with basic knowledge about information security and system security. The subject also provides knowledge to help students understand the potential risks in the current information technology era; apply that knowledge to build information security solutions; safely design, build and operate computer systems (including information use policies). Through the course, students become aware of ethics and responsibility in the use of information.

COURSE GOALS

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

1. Understand concepts and terms in the field of information security.
2. Understand security risks and how to fix them.
3. Understand wired network security.
4. Understand wireless network security.
5. Understand Standards in developing security policies.
6. Apply the provided knowledge to deploy a safe and secure system.

REQUIRED AND RECOMMENDED READING

[1] Lecture notes on computer security, lecturers.

[2] FAQ – Frequently Asked Questions about Today's Cryptography, 2000, RSA Laboratory.

[3] Cơ sở Lý thuyết số cho Bảo mật thông tin, Bùi Doãn Khanh, Nguyễn Đình Thúc, Trần Đan Thư, 2006, NXB Giáo dục.

CSC15002 - Database Security

GENERAL INFORMATION

Course ID:	CSC15002
Course name (English):	Database Security
Course name (Vietnamese):	Bảo mật cơ sở dữ liệu
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Data Structures and Algorithms, Introduction to Databases

COURSE DESCRIPTION

The course aims to help students understand and apply encryption and information security methods for designing and protecting an information system. Specifically, can understand and apply access control methods, traditional as well as modern database security methods. In addition, students can apply skills such as teamwork, can read English documents. In addition, in terms of attitude, students know about professional ethics and responsibility.

COURSE GOALS

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

1. Apply teamwork skills.
2. Apply reading skills on English documents related to the field of information/database security.
3. Practice critical thinking, professional ethics, and responsibility.
4. Use access control mechanisms provided by DBMSs.
5. Understand and can apply encryption methods for database security.
6. Understand and apply searchable encryption methods in relational database security.

REQUIRED AND RECOMMENDED READING

[1] An Introduction to Mathematical Cryptography., Jeffrey Hoffstein, Jill Pipher, and Joseph H. Silverman, 2008, Springer.

CSC15003 - Applied Cryptography

GENERAL INFORMATION

Course ID:	CSC15003
Course name (English):	Applied Cryptography
Course name (Vietnamese):	Mã hóa ứng dụng
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Programming

COURSE DESCRIPTION

The course is designed to provide students a broad introduction to cryptography and communication security mechanisms based on cryptography. The course covers fundamental aspects such as security evaluation criteria and the mathematical constructs underlying cryptographic primitives as well as applied aspects like the design of major encryption and hashing algorithms, details of security mechanisms relying on cryptography such as data encryption, integrity, digital signature, authentication, key management, and public-key infrastructures.

COURSE GOALS

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

1. Apply team work and individual work skills to learn the basic concepts of applied cryptography.
2. Know and explain English terminology in the field of Cryptography.
3. Understand the basic concepts, terms, responsibility and fundamental principles in the field of Cryptography.
4. Identify and categorize Cryptography algorithms for real world application.
5. Understand and apply techniques in the field of applying Cryptography.
6. Understand the methods to attack Cryptography algorithms.

REQUIRED AND RECOMMENDED READING

[1] Mã hóa ứng dụng, Dương Anh Đức, Trần Minh Triết, 2008, NXB ĐHQG TPHCM.

CSC15004 - Statistical Learning

GENERAL INFORMATION

Course ID:	CSC15004
Course name (English):	Statistical Learning
Course name (Vietnamese):	Học thống kê
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Data Structures and Algorithms

COURSE DESCRIPTION

The course is designed to introduce basic methods in machine learning models using probability and statistics. This course focuses students on applying knowledge in probability and statistics in learning machine learning models like linear regression, neural network, hidden Markov, support vector machine and decision tree. Students will learn these models, implement and apply them to solving some simple problems in pattern recognition and data analysis. This course will also require students to practice programming skills in order to build demonstration program, skills in collecting and standardize data and analyzing outcome models.

COURSE GOALS

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

1. Employ and apply reading, writing and presentation skills.
2. Understand concepts in statistics and machine learning in data analysis.
3. Apply statistical models (single and multivariate linear regression) to data analysis.
4. Apply machine models (neural network, hidden Markov, support vector machine, decision tree) to data modeling.
5. Solve practical problems in data analysis.

REQUIRED AND RECOMMENDED READING

[1] An Introduction to Statistical Learning (2nd Edition), Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani, 2021, Springer.

CSC15005 - Introduction to Cryptography

GENERAL INFORMATION

Course ID:	CSC15005
Course name (English):	Introduction to Cryptography
Course name (Vietnamese):	Nhập môn mã hóa – mật mã
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Programming

COURSE DESCRIPTION

The course aims to provide students with an introduction to the basic theory of applied cryptography and the mathematical concepts that underpin it. Throughout the course, students will gain a foundational understanding of applied cryptography (including encryption, decryption, digital signatures, secure protocols, and key management), explore the mathematical ideas behind cryptography, learn about commonly used cryptographic algorithms and protocols (including symmetric encryption algorithms, public-key encryption algorithms, hash functions, digital signatures, and secure communication protocols), and understand the practical applications of applied cryptography. By the end of the course, students will have a solid understanding of the basic theory of applied cryptography, the mathematical concepts that support it, and the practical applications of cryptographic techniques. They will be equipped with the foundational knowledge to explore more advanced topics in cryptography and apply cryptographic principles to secure communication and data protection challenges.

COURSE GOALS

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

1. Understand fundamental knowledge in cryptography.
2. Apply knowledge from multiple fields.
3. Read and understand academic literature.
4. Apply cryptography to practical applications.

REQUIRED AND RECOMMENDED READING

[1] Cơ sở Lý thuyết số trong An toàn - Bảo mật Thông tin, Bùi Doãn Khanh - Nguyễn Đình Thúc - Trần Đan Thư, 2007, NXBGD.

CSC15006 - Introduction to Natural Language Processing

GENERAL INFORMATION

Course ID:	CSC15006
Course name (English):	Introduction to Natural Language Processing
Course name (Vietnamese):	Nhập môn xử lý ngôn ngữ tự nhiên
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Data Structures and Algorithms

COURSE DESCRIPTION

The course is designed to provide students a basic introductory course to the problems of computer natural language processing. The course will introduce an overview of natural languages, emphasizing ambiguities at linguistic levels across different dimensions. The course will introduce morphological analysis methods; context-free grammar parsing algorithms for natural languages; and applications in English/Vietnamese processing. In addition, the course will also introduce some text analysis techniques and simple applications (spelling check, information search, ...).

COURSE GOALS

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

1. Understand the basic concepts of natural language processing (NLP), terminologies in natural language, the similarities and differences between English and Vietnamese in terms of automatic language processing.
2. Understand basic NLP problems such as morphological analysis, grammar analysis.
3. Apply parsing methods according to rule-based approaches and machine learning based approaches.
4. Utilize existing NLP toolkits to process texts.
5. Understand and utilize existing processing blocks in NLP systems.
6. Apply individual and group working skills to research and solve NLP problems.
7. Search and read technical documents in English.

REQUIRED AND RECOMMENDED READING

- [1] Xử lý Ngôn ngữ Tự nhiên, Đinh Điền, 2006, NXB ĐHQG.
- [2] Speech and Language Processing (2nd ed.), Dan Jurafsky and James H. Martin, 2009, Prentice Hall.
- [3] Natural Language Processing with PyTorch, Delip Rao and Brian McMahan, 2019, O'Reilly Media.

CSC15008 - Natural Language Processing and Applications

GENERAL INFORMATION

Course ID:	CSC15008
Course name (English):	Natural Language Processing and Applications
Course name (Vietnamese):	Xử lý ngôn ngữ tự nhiên ứng dụng
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Natural Language Processing

COURSE DESCRIPTION

The course is designed to provide students general knowledge about fundamental applications in the field of Natural Language Processing (NLP) through practical problems such as: text classification, text similarity, text summarization, machine translation... The subject also helps students have practical experiences in the process of building a NLP application at a simple level in a systematic and effective method.

COURSE GOALS

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

1. Apply team work and individual work skills to build reports on NLP applications.
2. Understand and explain English terminologies in NLP.
3. Develop skills in describing, analyzing and modeling a real-world NLP application.
4. Know and understand metrics to evaluate NLP applications.
5. Construct some simple NLP applications.
6. Understand NLP toolkits and libraries.

REQUIRED AND RECOMMENDED READING

- [1] Xử lý Ngôn ngữ Tự nhiên, Đinh Điền, 2006, NXB ĐHQG.
- [2] Statistical Machine Translation, Philipp Koehn, 2010, Cambridge University Press.
- [3] Neural Machine Translation, Philipp Koehn, 2020, Cambridge University Press.
- [4] Hands-On Natural Language Processing with Python: A practical guide to applying deep learning architectures to your NLP applications, Rajesh Arumugam and Rajalingappaa Shanmugamani, 2018, Packt Publishing.

CSC15007 - Computer Statistics and Applications

GENERAL INFORMATION

Course ID:	CSC15007
Course name (English):	Computer Statistics and Applications
Course name (Vietnamese):	Thống kê máy tính và ứng dụng
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Applied Statistics for Engineers and Scientists, Introduction to Programming

COURSE DESCRIPTION

Computational Statistics (or Statistical Computing) is a field that combines Statistics with Computer Science. It provides methods that leverage the computing power of computers for statistical inference and data analysis. This course covers such computationally intensive statistical methods, for example: resampling methods, Monte Carlo methods, and Markov chain Monte Carlo methods. The course also introduces tools to help students practice these methods within the Python computing ecosystem.

COURSE GOALS

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

1. Apply team work and individual work skills.
2. Explain terminologies in statistics/data science.
3. Explain terminologies in computer science.
4. Use applied mathematical problems.
5. Apply math knowledge to solve problems.
6. Apply Python programming.

REQUIRED AND RECOMMENDED READING

[1] Thống Kê Máy Tính, Nguyễn Đình Thúc - Đặng Hải Vân - Lê Phong, 2010, NXBKHK.T.

CSC15009 - Digital Signal Processing

GENERAL INFORMATION

Course ID:	CSC15009
Course name (English):	Digital Signal Processing
Course name (Vietnamese):	Xử lý tín hiệu số
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Programming, Data Structures and Algorithms

COURSE DESCRIPTION

The course covers the theory and methods of digital signal processing. Review of discrete-time, invariant linear systems, Fourier transform and Z transform, sampling, impulse response, frequency response, finite and infinite impulse response systems, design and digital filter implementation. And then implement applications for noise filtering, compression, embedding and data hiding in digital signals, compression, basic processing on digital audio and video signals.

COURSE GOALS

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

1. Understand the specialized English term and materials related to data recovery and safety (DSR).
2. Understand the basic knowledge and theory in Digital Signal Processing.
3. Understand basic concepts, properties of discrete time systems, analyze & calculate impulse response and response of invariant linear system.
4. Understand and apply the fundamental transformations Z, Fourier.
5. Understand and apply some methods of noise filtering, embedding or hiding data & signal compression.
6. Understand and apply some basic processing with digital audio signals.

REQUIRED AND RECOMMENDED READING

[1] Discrete-Time Signal Processing, Alan V. Oppenheim and Ronald W. Schaffer, 2009, Pearson.

CSC15010 - Blockchain and Applications

GENERAL INFORMATION

Course ID:	CSC15010
Course name (English):	Blockchain and Applications
Course name (Vietnamese):	Blockchain và ứng dụng
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Programming Techniques

COURSE DESCRIPTION

The course is designed to provide students basic cryptographic and blockchain knowledge. In particular, knowledge of public key cryptography, cryptographic hash functions, and how blockchain technology uses these cryptographic primitives. The content course consists of 4 parts (i) Blockchain database and consensus mechanisms; (ii) Basic components of the blockchain; (iii) Blockchain and cryptocurrencies; (iv) and advanced topics.

COURSE GOALS

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

1. Understand concepts and terms in decentralized application fields.
2. Understand and use cryptographic hash functions.
3. Understand and use public-key cryptosystems.
4. Understand and use digital signatures.
5. Practice P2P networks.
6. Understand basic concepts in game theory.

REQUIRED AND RECOMMENDED READING

[1] Cơ sở Lý thuyết số trong An toàn - Bảo mật Thông tin (phần mã công khai), Bùi Doãn Khanh - Nguyễn Đình Thúc - Trần Đan Thu, 2007, NXBGD.

CSC15011 - Introduction to Statistics Linguistics and Applications

GENERAL INFORMATION

Course ID:	CSC15011
Course name (English):	Introduction to Statistics Linguistics and Applications
Course name (Vietnamese):	Nhập môn ngôn ngữ học thống kê và ứng dụng
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Applied Statistics for Engineers and Scientists, Introduction to Programming

COURSE DESCRIPTION

The course is designed to provide students with an overview of the field of Statistical Linguistics, the background knowledge related to the preparation and construction of corpus for statistics, methods of statistics, testing to extract linguistic information from corpora. The course also helps to build the foundation knowledge for the Knowledge Technology major (Natural Language Processing field) in order to prepare for more specialized subjects in the following years. Additionally, the course helps students have practical experience in the process of building a corpus, processing and applying statistical and testing methods to exploit the corpus.

COURSE GOALS

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

1. Apply team work and individual work skills to research, construct, and exploit corpora.
2. Understand and apply at a basic level statistical methods, evaluating on real data.
3. Know the basic concepts of corpus, classification of corpus; criteria for building corpus, processing and exploiting corpus.
4. Identify, describe, analyze, and evaluate the structure and quality of a particular corpus.
5. Know and apply the criteria when collecting corpus (corpus balancing, representativeness, corpus sampling); corpus processing: language labeling at different linguistic levels and at different language levels; corpus mining.
6. Recognize the role and importance of statistical linguistics in preparing corpora.

REQUIRED AND RECOMMENDED READING

[1] Ngôn ngữ học Ngữ liệu, Đinh Điền, 2018, NXB ĐHQG-HCM.

[2] Corpus Linguistics and Linguistically Annotated Corpora, Sandra Kuebler, Heike Zinsmeister, 2015, Bloomsbury Academic.

CSC15102 - Social Network Analysis

GENERAL INFORMATION

Course ID:	CSC15102
Course name (English):	Social Network Analysis
Course name (Vietnamese):	Phân tích mạng xã hội
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Databases

COURSE DESCRIPTION

Social media enables people to connect and interact with each other anytime and anywhere. It allows us to observe human behavior on an unprecedented scale through a new lens - the social media lens. This lens provides us with opportunities to understand individuals and design computational systems that cater to their needs. Social media knows no geographical boundaries and continually generates data for each individual. Social media can be modeled through a social network, where individuals interact with each other through relationships such as friendships, emails, blogs, joint purchases of products, and various other mechanisms. In this real-world context, the course on exploring social networks is divided into three main parts. Part one provides the necessary foundational knowledge, including graph theory, network concepts, and social network models. Part two delves into the analysis of social network structures, specifically community analysis and analysis of interaction and information diffusion on social networks. In both parts, students will be taught general theoretical issues and then apply them to practical computations for network models such as Twitter. Part three of the course focuses on presenting how to utilize the analyzed information.

COURSE GOALS

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

1. Apply the skills of reading documents, writing reports, and making presentations.
2. Understand social network models (small-world model and Barabasi-Albert model) and models of diffusion and information propagation on social networks.
3. Use social network models and supporting tools for analyzing real social networks (such as Twitter).
4. Apply the acquired knowledge to develop practical applications using social networks.

REQUIRED AND RECOMMENDED READING

- [1] Social Network Analysis (Fourth Edition), John Scott, 2017, SAGE Publications Ltd.
- [2] Network Science, Albert-László Barabási, Márton Pósfai, 2016, Cambridge University Press.
- [3] Analyzing Social Networks (Second Edition), Stephen P Borgatti, Martin G. Everett, Jeffrey C. Johnson, 2013, SAGE Publications Ltd.

CSC15103 - Quantitative Finance

GENERAL INFORMATION

Course ID:	CSC15103
Course name (English):	Quantitative Finance
Course name (Vietnamese):	Tính toán tài chính
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Computer Statistics and Applications

REQUIRED AND RECOMMENDED READING

[1] Thống Kê Máy Tính, Nguyễn Đình Thúc - Đặng Hải Vân - Lê Phong, 2010, NXBKHKHT.

CSC15104 - Data Safety and Recovery

GENERAL INFORMATION

Course ID:	CSC15104
Course name (English):	Data Safety and Recovery
Course name (Vietnamese):	An toàn và phục hồi dữ liệu
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Operating Systems, Computer Networking

COURSE DESCRIPTION

Data or information plays important roles, eventually more than physical property; it does not exist then neither do lives. One of the most dangerous cases which would likely happen nowadays is data loss, whose consequences negatively affect any person, business or organization. This course provides basics of data organization of digital devices and introduces methods of data protection, as well as how to recover lost data.

COURSE GOALS

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

1. Understand the specialized English term and materials related to data recovery and safety.
2. Practice presentation and report writing skills Practice skills of discovering and developing methods to solve problems.
3. Understand storage architectures and data organization mechanisms of storage devices, basic data formats. Discover and conduct experiments on methods of accessing data directly on devices.
4. Understand and apply data recovery methods.
5. Understand and apply methods of protecting and securing data.
6. Understand and organize a storage architecture given requirements of data safety.

REQUIRED AND RECOMMENDED READING

- [1] Computer and Information Security Handbook, John Vacca, 2017, Elsevier.
- [2] Computer Security: Principles and Practice, 4th edition, William Stallings, Lawrie Brown, 2018, SAGE Publications Ltd.
- [3] Data Protection: Ensuring Data Availability, Preston de Guise, 2020, CRC Press.
- [4] Data Recovery For Normal People, Allan Hall, 2016, CreateSpace Independent Publishing Platform.

CSC15105 - Text Mining and Applications

GENERAL INFORMATION

Course ID:	CSC15105
Course name (English):	Text Mining and Applications
Course name (Vietnamese):	Khai thác dữ liệu văn bản và ứng dụng
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Natural Language Processing

COURSE DESCRIPTION

The course is designed to provide students with an overview of the field of corpus mining, introducing concepts and methods to discover linguistic knowledge from large textual data. The course also helps to build the foundation knowledge for the Knowledge Technology major (Natural Language Processing field) in order to prepare for more specialized subjects in the following years. The course also helps students experience the application of data mining techniques to solve problems in life: business, education, health, ...

COURSE GOALS

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

1. Apply team work and individual work skills to research, apply textual corpus mining, and present results.
2. Know the basic concepts of text corpus mining.
3. Understand and distinguish important terminologies in text corpus mining.
4. Understand and apply the text mining methods to apply to actual textual data.
5. Recognize the role and importance of text corpus mining through applications in daily life.

REQUIRED AND RECOMMENDED READING

- [1] Text Mining with Machine Learning, Jan Žižka, František Darena, Arnošt Svoboda, 2021, CRC Press.
- [2] Text Mining: Applications and Theory, Michael W. Berry and Jacob Kogan, 2010, Wiley.
- [3] Sentiment Analysis and Opinion Mining, Bing Liu, 2012, Morgan & Claypool.

CSC15106 - Knowledge Engineering Seminars

GENERAL INFORMATION

Course ID:	CSC15106
Course name (English):	Knowledge Engineering Seminars
Course name (Vietnamese):	Seminar Công nghệ tri thức
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course is designed to provide students with an overview of the major research directions in the Department of Knowledge Engineering (KE). It consists of a series of seminars about various research topics in the fields of artificial intelligence (AI) and machine learning (ML), spoken language processing (SLP), and information security (IS). Each topic will be presented by experts in the fields, from advanced research to practical applications. In addition, the course will further provide students with the basic research skills, including proposal writing and research results representation.

Students of the Knowledge Engineering Department are encouraged to take this course to discover their research interests, as well as to get ready for their thesis.

COURSE GOALS

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

1. Understand the basic concepts of AI and the main research directions of the Department of Knowledge Engineering.
2. Understand the main research topics and solutions in spoken language processing.
3. Understand the fundamentals of cryptography and its applications in security systems and blockchains.
4. Apply writing skill on a research proposal and present a research result.

REQUIRED AND RECOMMENDED READING

[1] Knowledge Engineering: The Process Paradigm, Hamed Fazlallahtabar, 2020, CRC Press.

CSC15107 - Privacy-Preserving Data Analysis

GENERAL INFORMATION

Course ID:	CSC15107
Course name (English):	Privacy-Preserving Data Analysis
Course name (Vietnamese):	Phân tích dữ liệu bảo toàn tính riêng tư
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Databases

REQUIRED AND RECOMMENDED READING

[1] Differential Privacy: From Theory to Practice, Ninghui Li, Min Lyu, Dong Su, Weining Yang, 2016, Morgan&Claypool Publishers.

CSC15201 - Capstone Projects in Applied Cryptography and Information Security

GENERAL INFORMATION

Course ID:	CSC15201
Course name (English):	Capstone Projects in Applied Cryptography and Information Security
Course name (Vietnamese):	Đồ án Mã hóa ứng dụng và an ninh thông tin
Relation to curriculum:	Graduating works (elective)
Credit points:	6 credits (Theory: 0; Laboratory: 6) / ~ 12 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The projects are designed to help learners objectively evaluate different cryptographic methods as they may be applied to cybersecurity. The project assignments are graded assessments..

COURSE GOALS

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

1. Understand specialized concepts and terms in the field of information security.
2. Understand vulnerability in information/data security.
3. Understand concepts on applied cryptography.
4. Understand symmetric cryptosystems and hash functions.
5. Understand asymmetric cryptosystems.
6. Apply the provided knowledge to deploy a safe and secure system.

REQUIRED AND RECOMMENDED READING

[1] FAQ – Frequently Asked Questions Today’s Cryptography, RSA Lab, 2000, RSA Laboratory.

CSC15202 - Capstone Projects in Computational Linguistics

GENERAL INFORMATION

Course ID:	CSC15202
Course name (English):	Capstone Projects in Computational Linguistics
Course name (Vietnamese):	Đồ án Ngôn ngữ học tính toán
Relation to curriculum:	Graduating works (elective)
Credit points:	6 credits (Theory: 0; Laboratory: 6) / ~ 12 ECTS credits
Prior course(s):	Programming Techniques

COURSE DESCRIPTION

The course is designed to provide students with the knowledge of Natural Language Processing (NLP) in practical projects related to Computational Linguistics (CL) such as: building a text classification system, building a detect plagiarism, building a translation support system, building a text difficulty rating system, building an author identification system, etc. This course also provides skills in description, analysis and implementation; applies learned problems to build systems of NLP in practice; helps students improve their ability to learn new approaches/technologies for their own problems; improves reading English documents, reporting ability and teamwork.

COURSE GOALS

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

1. Apply team work and individual work skills to build reports on CL systems.
2. Examine, analyse the components of CL systems.
3. Develop skills to describe, analyze and model a CL system in practice.
4. Practice some of CL systems at a basic level.
5. Use evaluation metrics to evaluate CL systems.
6. Utilize existing toolkits and libraries.

REQUIRED AND RECOMMENDED READING

[1] Từ điển học Tính toán, Đinh Điền, 2019, NXB ĐHQG TPHCM.

CSC16001 - Computer Graphics

GENERAL INFORMATION

Course ID:	CSC16001
Course name (English):	Computer Graphics
Course name (Vietnamese):	Đồ họa máy tính
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Programming

COURSE DESCRIPTION

The course provides the basic knowledge of Computer Graphics to simulate two-dimensional and three-dimensional objects for application in fields such as CAD, CAM, Game, Simulation, Augmented Reality, Advertising, Education ... Content includes main parts such as methods of drawing two-dimensional objects (Lines, Arcs, Bezier, Hatch), three-dimensional objects (Wireframe model with perspective projection and visible-surface detection).) and geometric transformations (2D and 3D geometry transformations). In addition, the subject also provides skills for proficient use of the OpenGL, OpenGL ES. WebGL graphics library.

COURSE GOALS

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

1. Recognize the roles of individuals and groups in group activities in response to Computer Graphics learning requirements.
2. Recognize English documents of computer graphics.
3. Apply learned methods to analyze and solve problems related to computer graphics.
4. Interpret and apply a two-dimensional real-world simulation method based on Euclidean geometry.
5. Interpret and apply a three-dimensional real-world simulation method based on Euclidean geometry.

REQUIRED AND RECOMMENDED READING

[1] Computer Graphics with OpenGL, Donald Hearn and M. Pauline Baker, Carithers, 2014, Pearson Education Limited.

CSC16002 - Mathematical Methods for Visual Information Analysis

GENERAL INFORMATION

Course ID:	CSC16002
Course name (English):	Mathematical Methods for Visual Information Analysis
Course name (Vietnamese):	Phương pháp toán trong phân tích dữ liệu thị giác
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Programming

COURSE DESCRIPTION

In the trend there are many revolutionary changes in the field of visual information analysis such as Depth image|video; Extremely large image|video data sets; Deep learning methods, increasingly powerful computing capabilities, etc., Mastering new knowledge of effectively exploiting visual data plays an increasingly important role.

This subject is an urgent bridge supplementing knowledge about Computing in Computer Graphics, Digital Image and Video Processing, Computer Vision, contributing to improving the intelligent of the vision system.

The content includes the main parts such as image-video analysis based on metric space, vector space, based on optimization method, based on a system of linear equations, based on a system of nonlinear equations, and based on the differential equations, based on deep learning,.

The course provides foundational knowledge of:

Image-video analysis is based on metric space to exploit research results in metric space to apply to image-video data analysis.

Image-video analysis is based on vector space to exploit research results in vector space to apply to image-video data analysis.

Image-video analysis is based on optimal methods that are often encountered by problems in Visual Data Science such as object representation, detection, recognition, tracking, retrieval, reconstruction, and restoration.

Image-video analysis is based on a system of linear and nonlinear equations that commonly encountered problems in Visual Data Science such as 3D object reconstruction, Robot Navigation.

Image-video analysis is based on partial differential equations that are often encountered by problems in Visual Data Science such as 3D object reconstruction, Robot Navigation, Automatic Image Collage.

Image-video analysis is based on deep learning method to overcome the shortcomings of semantic gaps and handle large amounts of data of the traditional process in feature extraction-object representation-classification.

COURSE GOALS

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

1. Practice the role of individuals and groups in group activities to improve the quality of learning in Mathematical methods in visual data analysis.
2. Practice English documents and Presentation in English for Mathematical methods in visual data analysis.

3. Analyze and Propose analytical and problem-solving methods related to the Mathematical methods in visual data analysis.
4. Analyze and Propose image|video analysis based on data space.
5. Analyze and Propose image|video analysis based on optimal method.
6. Analyze and Propose image|video analysis based on linear - nonlinear equations system.
7. Analyze and Propose image|video analysis based on partial differential equation.
8. Analyze and Propose image|video analysis based on deep learning method.

REQUIRED AND RECOMMENDED READING

- [1] Scientific Computing 2nd Edition, Michael T. Heath, University of Illinois, 2002, The McGraw-Hill Companies.
- [2] Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, 2016, MIT.

CSC16003 - Multivariate Statistical Analysis

GENERAL INFORMATION

Course ID:	CSC16003
Course name (English):	Multivariate Statistical Analysis
Course name (Vietnamese):	Phân tích thống kê dữ liệu nhiều biến
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Programming

COURSE DESCRIPTION

This course provides the basic and advanced knowledge on Multivariate Statistical Analysis (MSA) to analyze and exploit multivariable data for application in fields such as: Business, Insurance, Stock, Society, Security, Defense, Education, Data Science, Big Data... The content includes the main parts such as The basic concepts in MSA, Multivariate Linear Regression Model, Principal Component Analysis , Factor analysis, Canonical correlation analysis, Clustering, Classification.

COURSE GOALS

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

1. Practice the role of individuals and groups in teamwork to enhance learning about MSA.
2. Practice reading books and presenting presentations and paper in English on MSA.
3. Analyze problem solving methods related to MSA to improve the effectiveness of the solution.
4. Apply and Analyze the process of designing and implementing a multivariate data analysis method.
5. Apply and Analyze the process of designing and implementing clustering, classification method.
6. Propose the process of designing and implementing MSA system in practical applications.

REQUIRED AND RECOMMENDED READING

- [1] Applied Multivariate Statistical Analysis (6th edition), Richard A. Johnson, Dean W. Wichern, 2007, Person Education.
- [2] Applied Multivariate Statistical Analysis, Wolfgang Karl Hardle, Leopold Simar, 2012, Springer.

CSC16004 - Computer Vision

GENERAL INFORMATION

Course ID:	CSC16004
Course name (English):	Computer Vision
Course name (Vietnamese):	Thị giác máy tính
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Programming

COURSE DESCRIPTION

The computer vision course will provide knowledge about how to define and detect the features of images and video. Some basic problems of computer vision will be explained in this course such as image features, object detection, object tracking, object recognition, etc. This course will also provide skills in computer programming using OpenCV through its project final. It helps students implement knowledge of software engineering and computer vision into software application systematically.

COURSE GOALS

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

1. Interpret the roles of individuals and groups in response to earning requirements.
2. Interpret concepts and terms in the field of computer vision.
3. Interpret basic solutions for fundamental problems and applications of computer vision.
4. Practice and enhance computer programming using OpenCV toolkit.
5. Discuss research papers or technical report.
6. Recognize the roles and applications of computer vision in academic and industry.

REQUIRED AND RECOMMENDED READING

[1] Computer Vision: A Modern Approach (2nd Edition), David Forsyth, Jean Ponce, 2011, Pearson.

CSC16005 - Digital Image and Video Processing

GENERAL INFORMATION

Course ID:	CSC16005
Course name (English):	Digital Image and Video Processing
Course name (Vietnamese):	Xử lý ảnh số và video số
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Programming

COURSE DESCRIPTION

Visual information plays an increasingly important role in human life: in the process of production and social management. Images|Videos are digitized with increasing quality and quantity. This leads to the essential need to exploit visual information to achieve useful applications in production such as Fault Detection on Microelectronic Equipment, Automated product sorting on the line, automation in harvesting agricultural products, 3D object reconstruction for 3D printing, etc.; in social management such as: eKYC system, Intelligent Transportation System, Intelligent Monitoring System, Intelligent Disease Diagnosing based on medical images, Intelligent Image Retrieval system, Image Restoration, Image Compression, etc.

This course aims to provide students the fundamental knowledge and advanced knowledge in digital image and video processing (image|video representation, image|video preprocessing, image|video segmentation, image transformation, image compression). The course supports students accumulate skills in building basic image and video processing systems for practical applications. Based on the provided knowledge and skills, students will easily acquire knowledge from subjects of Visual Data Science.

And more importantly, the subject helps the students understand the principles of solutions and achieve experience through practical experience in building specific applications that meet the requirements of Industrial Revolution 4.0.

COURSE GOALS

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

1. Recognize the roles of individuals and groups in group activities in response to learning about digital image and video processing (DIP).
2. Recognize English documents and Presentation in English about DIP.
3. Recognize analytical and problem-solving methods related to the DIP.
4. Interpret and apply process of designing and implementing image|video pre-processing.
5. Interpret and apply process of designing and implementing image|video transformations.
6. Interpret and apply process of designing and implementing image|video segmentation.
7. Interpret and apply process of designing and implementing image|video compression.
8. Practice a simple process of designing and implementing an image|video processing system.

REQUIRED AND RECOMMENDED READING

[1] Digital Image Processing 4th Edition, Rafael C. Gonzalez, Richard E. Woods, 2017, Pearson.

[2] Learning Image Processing with OpenCV, Gloria Bueno García Oscar Deniz Suarez José Luis Espinosa Aranda Jesus Salido Tercero Ismael Serrano Gracia Noelia Váñez Enano, 2015, Packt Publishing.

CSC16101 - Applied Computer Graphics

GENERAL INFORMATION

Course ID:	CSC16101
Course name (English):	Applied Computer Graphics
Course name (Vietnamese):	Đồ họa ứng dụng
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Programming

COURSE DESCRIPTION

The course is designed to provide students the foundational & methodology knowledge of Applying Computer Graphics to real-world applications and develop applications based on existing graphics software to quickly meet requirements in fields such as CAD, CAM, Game, Simulation, Augmented Reality, Advertising, Education... The content includes key sections such as the method of using 2D & 3D design software (CorelDraw, PhotoShop, AutoCAD, SketchUp), holographic (AutoCAD, 3DStudio Max) and methods of developing applications based on graphics software with embedded languages such as Visual Lisp, VBA.

COURSE GOALS

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

1. Practice on an individual and groups to present a number of technical reports in applications of computer graphics.
2. Identify problems related to the field of Application of Computer Graphics.
3. Interpret 2D and 3D graphics in engineering design software.
4. Practice animations and rendering in computer graphics software.
5. Practice embedded language in graphic and engineering design software.
6. Recognize the application of computer graphics in industry context.

REQUIRED AND RECOMMENDED READING

- [1] WebGL Insights, Patrick Cozzi, 2015, A K Peters/CRC Press.
- [2] SketchUp For Dummies (For Dummies (Computer/Tech)) 2nd Edition, Bill Fane, Mark Harrison, Josh Reilly, 2020, For Dummies.
- [3] Practical Paint.NET: The Powerful No-Cost Image Editor for Microsoft Windows, Phillip Whitt, 2021, Apress.
- [4] Phát triển AutoCAD bằng ActiveX & VBA, Lê Quỳnh Mai (chủ biên), Trương Thanh Hoàng, Hoàng Thùy Linh, Hiệu đính: Bùi Công Độ.

CSC16102 - Programming Techniques in Digital Image and Video Processing

GENERAL INFORMATION

Course ID:	CSC16102
Course name (English):	Programming Techniques in Digital Image and Video Processing
Course name (Vietnamese):	Kỹ thuật lập trình xử lý ảnh số và video số
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Programming, Digital Image and Video Processing

COURSE DESCRIPTION

The course is designed to provide students with basic and advanced programming techniques with C++11/14 in the domain of processing digital image and video and general one. The content includes dynamically linked or shared library, template meta programming, type deduction, move semantics, lambda expressions, smart pointers, cross platform thread and (a)synchronous facilities.

COURSE GOALS

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

1. Practice the roles of individuals and groups in group activities in response to earning requirements.
2. Practice features of C++ from version 14 for Digital Image and Video Processing.
3. Apply the optimize techniques in image and video computing.
4. Practice the princile of seperation of concern into image and video processing.
5. Practice open source technologies in the best practices for image and video problem.
6. Recognize the solutions for the best practices in image and video processing.

REQUIRED AND RECOMMENDED READING

- [1] Effective Modern C++: 42 Specific Ways to Improve Your Use of C++11 and C++14, Scott Meyers, 2015, O'Reilly Media.
- [2] A Practical Introduction to Computer Vision with OpenCV, Kenneth Dawson-Howe, 2014, Wiley.

CSC16104 - Robot Vision

GENERAL INFORMATION

Course ID:	CSC16104
Course name (English):	Robot Vision
Course name (Vietnamese):	Thị giác robot
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Programming

COURSE DESCRIPTION

The course starts with probability revisit, then provides students with essential concepts, laws and formulas in probabilistic approach to problem of mobile robot localization and mapping. Probabilistic models in motion, perception and building robot assumptions about its dynamic environment are presented next. The course ends with a realistic and hot problem of Simultaneous localization and mapping in an unknown environment.

COURSE GOALS

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

1. Interpret the roles of individuals and groups in response to earning requirements.
2. Interpret concepts and terms in the field of robotics.
3. Choose feasible probabilistic models to build robotics vision system.
4. Practice and simulate robotics vision system.
5. Discuss research papers or technical report.
6. Recognize the roles of SLAM and CV in academic and industry robotics.

REQUIRED AND RECOMMENDED READING

[1] Probabilistic Robotics (Intelligent Robotics and Autonomous Agents series), Sebastian Thrun, Wolfram Burgard and Dieter Fox, 2005, The MIT Press.

CSC16105 - Visual Information Retrieval

GENERAL INFORMATION

Course ID:	CSC16105
Course name (English):	Visual Information Retrieval
Course name (Vietnamese):	Truy vấn thông tin thị giác
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Programming

COURSE DESCRIPTION

This course provides basic knowledge on data organization and retrieval methods to exploit two basic attributes of digital images and digital video, which are visual cues and semantic, to meet the requirements in real applications. The content consists of main parts such as visual features extraction, including: methods of extracting low-level features, regional features, and local features; the visual data organization part includes: organizing image and video data at the visual and semantic level; the visual data retrieval part includes: image and video query at visual and semantic level; Evaluation of the performance of the system includes: qualitative and quantitative evaluation. In addition, the course also provides skills in using the OpenCV image and video processing library in image and video retrieval.

COURSE GOALS

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

1. Practice the role of individuals and groups in group activities to improve the quality of learning in Visual Information Retrieval.
2. Practice English documents and Presentation in English for Visual Information Retrieval.
3. Analyze analytical and problem-solving methods related to the Visual Information Retrieval.
4. Analyze visual feature extraction.
5. Analyze visual data organization.
6. Analyze visual data retrieval.

REQUIRED AND RECOMMENDED READING

[1] Visual Indexing and Retrieval, Jenny Benois-Pineau, Frédéric Precioso, Matthieu C, 2012, Springer Publishers.

CSC16106 - Introduction to Smart Device Programming

GENERAL INFORMATION

Course ID:	CSC16106
Course name (English):	Introduction to Smart Device Programming
Course name (Vietnamese):	Nhập môn lập trình điều khiển thiết bị thông minh
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Programming

COURSE DESCRIPTION

This course provides basic knowledge about the artificial intelligence of things. The course reviews deep learning techniques and provides a process to deploy deep learning models on embedded devices. Specifically, the main topics are as follows: Collecting training data; Training the deep learning model; Optimizing the deep learning model for embedded devices; Deploying a deep learning model for an application on embedded devices. The course provides the foundation for students to participate in projects to build intelligent devices such as smart bands, smart cameras, smart speakers....

COURSE GOALS

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

1. Practice on an individual and groups to present a number of technical reports or projects.
2. Interpret concepts and terms in the field of smart devices.
3. Explain the process of developing intelligent devices.
4. Practice digital signal processing to process input signal data.
5. Practice and enhance computer programming using tinyML toolkit.
6. Choose AI models and embedded programming to develop applications for smart devices.

REQUIRED AND RECOMMENDED READING

[1] TinyML: Machine Learning with TensorFlow Lite on Arduino and Ultra-Low-Power Microcontrollers, Pete Warden and Daniel Situnayake, 2020, O'Reilly Media.

CSC16107 - Applications of Computer Vision

GENERAL INFORMATION

Course ID:	CSC16107
Course name (English):	Applications of Computer Vision
Course name (Vietnamese):	Ứng dụng thị giác máy tính
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Programming

COURSE DESCRIPTION

Image and video plays important role in human life, nowadays. The data of images and videos are digitized with increasing quality and quantity. Have you ever wondered how digitized images can be exploited to achieve useful applications in life such as medical imaging diagnostics, fault detection on microelectronics, image recovery, and other tools? Search can index billions of images and videos, robots can navigate space and perform tasks? In this subject, students will explore all the technologies and ways of creating commercialized industrial products in practice. At the heart of modern artificial intelligence (AI) applications, AI technologies can perceive, understand, and reconstruct the complex visual world. Computer Vision (CV) is one of the fastest growing and most exciting disciplines in both academia and industry today. The course is designed to open new opportunities for students who want to study about the fundamentals and important applications of CV. More importantly, the course will guide the students through a series of real-world projects so that the students are knowledgeable in the application of advanced AI algorithms in the industrial fields.

COURSE GOALS

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

1. Practice on an individual and groups to present a number of technical reports in the field of computer vision.
2. Interpret how to build software product.
3. Outline how to start professional activities through course projects, analyze ideas for future products.
4. Construct a software product in computer vision with regard to concrete requirements.
5. Practice open source technologies to build a computer vision system.
6. Recognize the applications of computer vision in industry context.

REQUIRED AND RECOMMENDED READING

- [1] Computer Vision: Algorithms and Applications, Richard Szeliski, 2022, Springer.
- [2] Dive into Deep Learning, Zhang, Aston and Lipton, Zachary C. and Li, Mu and Smola, Alexander J., 2021, <https://d2l.ai/>.

CSC16109 - Applications in Digital Image and Video Processing

GENERAL INFORMATION

Course ID:	CSC16109
Course name (English):	Applications in Digital Image and Video Processing
Course name (Vietnamese):	Ứng dụng xử lý ảnh số và video số
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Programming

COURSE DESCRIPTION

In the trend of the 4th technology revolution with the process of Robotization, Internet of Things (IoT), Building Smart City, Building Smart Home, Manufacturing from 3D printing technology, Smart Camera, Digital Marketing and E-commerce, the applications of image and video play an increasingly important role.

This course is an urgent bridge from basic knowledge in Digital Image and Video Processing, Computer Vision and Computer Graphics to practical applications that society needs, in line with the training process according to the 4th technology revolution.

This course is intended to provide students with practical experience in designing the applications related to image & video. The content includes the main parts such as applications in the fields of digital marketing and e-commerce; smart city construction; self-driving devices such as Mobile Robot and Drone devices; 3D object reconstruction for 3D printing technology; Human-machine interaction; Medical image processing; Intelligent Agriculture.

COURSE GOALS

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

1. Practice the roles of individuals and groups in group activities in response to learning about applied digital image and video processing (Applied DIP).
2. Practice English documents and Presentation in English about Applied DIP.
3. Analyze analytical and problem-solving methods related to the Applied DIP.
4. Analyze process of designing and implementing application in digital marketing and e-commerce..
5. Analyze process of designing and implementing application in smart city construction.
6. Analyze process of designing and implementing application in self-driving devices.
7. Analyze process of designing and implementing application in 3D printing technology.
8. Analyze a simple process of designing and implementing application in human-machine interaction.

REQUIRED AND RECOMMENDED READING

- [1] Digital Image Processing 4th Edition, Rafael C. Gonzalez, Richard E. Woods, 2019, Springer.
- [2] Learning Image Processing with OpenCV, Gloria Bueno García Oscar Deniz Suarez José Luis Espinosa Aranda Jesus Salido Tercero Ismael Serrano Gracia Noelia Vázquez Enano, Packt Publishing, 2015, Packt Publishing.

CSC16110 - Selected Topics in Computer Graphics

GENERAL INFORMATION

Course ID:	CSC16110
Course name (English):	Selected Topics in Computer Graphics
Course name (Vietnamese):	Chuyên đề Đồ họa máy tính
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Computer Graphics

COURSE DESCRIPTION

The course is designed to provide students the basic principles of 3D computer graphics: meshes, transforms, cameras, materials, lighting, and animation. By the end of this course students will know enough to make an animated 3D program that runs in a web browser (using ThreeJS/WebGL), while also understanding the basic principles of how realistic computer images are generated.

COURSE GOALS

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

1. Practice on an individual and groups to present a number of technical reports in the field of digital computer graphics.
2. Interpret object simulation methods in 3D space.
3. Interpret the motion and interaction simulation methods in 3D space.
4. Practice computer programming using WebGL toolkit.
5. Recognize 3D graphics in academic and industry context.

REQUIRED AND RECOMMENDED READING

[1] Interactive Computer Graphics: A Top-Down Approach with WebGL 7th Edition, Edward Angel, 2014, Pearson.

CSC16111 - Selected Topics in Computer Vision

GENERAL INFORMATION

Course ID:	CSC16111
Course name (English):	Selected Topics in Computer Vision
Course name (Vietnamese):	Chuyên đề Thị giác máy tính
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Computer Vision

COURSE DESCRIPTION

This course aims to develop ability to study frontiers of computer vision researches. This course will cover advanced topics in computer vision, such as 1) Facial Recognition, 2) Object Detection, 3) Video Summarization, 4) Person Re-Identification, 5) Instance Segmentation. Students will work on group projects related to concrete research problems and present their research results in the form of seminars. There are many open problems in this area suitable for investigation by Master's or PhD students.

COURSE GOALS

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

1. Practice on an individual and groups to present a number of technical reports in the field of computer vision.
2. Revise research literature and state-of-the-art techniques for solving the challenging research problems in those areas.
3. Formulate problems, propose effective solutions to the problem and implement algorithms using suitable programming languages.
4. Evaluate the results and effectively evaluate the results on benchmark datasets.
5. Practice to write a research proposal for computer vision problem.

REQUIRED AND RECOMMENDED READING

- [1] Computer Vision: Models, Learning, and Inference, Simon J.D. Prince, 2011, Cambridge University Press.
- [2] Dive into Deep Learning, Zhang, Aston and Lipton, Zachary C. and Li, Mu and Smola, Alexander J., 2021, <https://d2l.ai/>.
- [3] Computer Vision: Algorithms and Applications, Richard Szeliski, 2022, Springer.

CSC16112 - Selected Topics in Image and Video Processing

GENERAL INFORMATION

Course ID:	CSC16112
Course name (English):	Selected Topics in Image and Video Processing
Course name (Vietnamese):	Chuyên đề Xử lý ảnh số và video số
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Digital Image and Video Processing

COURSE DESCRIPTION

The course is designed to provide students novel topics of digital image and video processing. The course includes sections of image filtering, object detection, segmentation, video tracking. At the end of the course, students are able to understand key concepts of image processing, build some practical applications in areas of computer vision, image and video processing, master programming skills of image processing with computer vision libraries.

COURSE GOALS

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

1. Practice on an individual and groups to present a number of technical reports in the field of digital image and video processing.
2. Revise research literature and state-of-the-art techniques for solving the challenging research problems in those areas.
3. Formulate problems, propose effective solutions to the problem and implement algorithms using suitable programming languages.
4. Evaluate the results and effectively evaluate the results on benchmark datasets.
5. Practice to write a research proposal for digital image and video processing problem.

REQUIRED AND RECOMMENDED READING

- [1] Deep learning for Vision Systems, Mohamed Elgendy, 2020, Manning.
- [2] Deep Learning for Computer Vision, Rajalingappaa Shanmugamani, 2018, Packt.
- [3] CS231n: Convolutional Neural Networks for Visual Recognition, Khóa học cs231n của đại học Stanford.
- [4] Deep Learning (Adaptive Computation and Machine Learning series) Illustrated Edition, Ian Goodfellow, Yoshua Bengio, Aaron Courville, 2016, The MIT Press.

CSC17001 - Intelligent Data Analysis

GENERAL INFORMATION

Course ID:	CSC17001
Course name (English):	Intelligent Data Analysis
Course name (Vietnamese):	Phân tích dữ liệu thông minh
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Data Structures and Algorithms

COURSE DESCRIPTION

The course is designed to introduce the applications of Artificial Intelligence techniques in data analysis across a variety of disciplines. These techniques include (but are not limited to): all areas of data visualization, data pre-processing, data engineering, mining techniques, tools and applications, use of domain knowledge in data analysis, machine learning. This course provides fundamental skills and open problems for students who are going to do further research in data analysis.

COURSE GOALS

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

1. Execute the main steps in data analysis.
2. Use appropriate tools/techniques to solve a given problem.
3. Develop new ideas for problems in this course.

REQUIRED AND RECOMMENDED READING

- [1] Practical Data Analysis, Hector Cuesta, Dr. Sampath Kumar, 2016, Packt Publishing Ltd.
[2] Practical Statistics for Data Scientists, 2nd Edition, Peter Bruce, Andrew Bruce, Peter Gedeck, 2020, O'Reilly Media, Inc.

CSC17107 - Applications of Intelligent Data Analysis

GENERAL INFORMATION

Course ID:	CSC17107
Course name (English):	Applications of Intelligent Data Analysis
Course name (Vietnamese):	Ứng dụng phân tích dữ liệu thông minh
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Intelligent Data Analysis

COURSE DESCRIPTION

The course is designed to help students employ analytic background and skills in real problems. By conducting a complete analysis: problem formulating, collecting and preprocessing data, knowledge extracting, and designing reports. During this course, students experience challenges in data analysis that improves analytic skills.

COURSE GOALS

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

1. Use reasoning and problem-solving skills.
2. Experiment, validate, and explore knowledge.
3. Manage projects effectively.
4. Demonstrate presentation skills.

REQUIRED AND RECOMMENDED READING

- [1] Practical Data Analysis, Hector Cuesta Dr. Sampath Kumar, 2016, Packt Publishing.
[2] Practical Statistics for Data Scientists, 2nd Edition, Peter Bruce, Andrew Bruce, Peter Gedeck, 2020, O'Reilly Media, Inc.

CSC17101 - Recommender Systems

GENERAL INFORMATION

Course ID:	CSC17101
Course name (English):	Recommender Systems
Course name (Vietnamese):	Hệ thống tư vấn
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Data Structures and Algorithms

COURSE DESCRIPTION

Due to the rapid growth of the Internet, consumers face serious challenges from information overload. With a huge number of options to choose from, they have a lot of difficulties viewing, finding, and selecting items. Recommender systems can resolve this dilemma as they extract user preferences from past interactions and recommend items that best suit a user's preferences. Thanks to the ability to predict user trends, recommender systems significantly improve the user experience. From the sellers' perspective, the results from recommender systems help them make better business decisions concerning marketing strategies, supply management, etc. It is expected, therefore, that the recommendation modules will gradually play an increasingly more important role in e-commerce systems. Evidence for this is that many Internet businesses, such as Netflix and Amazon, have achieved great success in applying recommender systems to serve customers. The course is designed to provide students with knowledge related to the development of recommender systems.

COURSE GOALS

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

1. Use skills for reading English materials in the field of recommender systems.
2. Express the issues related to recommender systems.
3. Practicing critical and creative thinking in the field of recommender systems.
4. Use relevant technologies to implement recommender systems.

REQUIRED AND RECOMMENDED READING

[1] Recommender Systems Handbook, Francesco Ricci, Lior Rokach, Bracha Shapira, 2022, Springer.

CSC17102 - Deep Learning for Data Science

GENERAL INFORMATION

Course ID:	CSC17102
Course name (English):	Deep Learning for Data Science
Course name (Vietnamese):	Học sâu cho khoa học dữ liệu
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Introduction to Machine Learning

COURSE DESCRIPTION

The course is designed to provide students advanced knowledge in machine learning techniques (classifying, clustering and feature representation) using deep learning and transfer learning models. Students practice with real projects such as sentiment analysis, face recognition, image generation. This course provides fundamental skills and open problems students who are going to do further research in artificial intelligence, natural language processing and computer vision.

COURSE GOALS

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

1. Operate basic deep learning architectures.
2. Construct an appropriate model for a given problem.
3. Develop new ideas for problems in this course.

REQUIRED AND RECOMMENDED READING

- [1] Deep Learning, Ian Goodfellow, Yoshua Bengio and Aaron Courville, 2016, MIT Press.
- [2] Deep Learning with Python, Second Edition, Francois Chollet, 2021, Manning.

CSC17103 - Graph Mining

GENERAL INFORMATION

Course ID:	CSC17103
Course name (English):	Graph Mining
Course name (Vietnamese):	Khai thác dữ liệu đồ thị
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Fundamentals of Artificial Intelligence

COURSE DESCRIPTION

The course aims to provide students with the basics of the field of graph data mining as well as its applications in practice. Specifically, the course begins with general contents related to the representation and indexing of graph data how features are exploited. Next, problems such as graph pattern, classification, clustering, community discovery, linked prediction, graph embedding are presented. At the same time, each algorithm in these sections is illustrated through libraries built on Python language such as NetworkX, iGraph, py_graph.

COURSE GOALS

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

1. Construct scientific reports and subject-related content in teamwork.
2. Explain the English terms used in the field of graph mining.
3. Explain the basic concepts and terminology used in the field of graph mining.
4. Describe the meaning and application of graph data mining problems to real-world problems.
5. Explain how basic algorithms work in graph data mining.
6. Construct some components of a small-scale graph data mining system.
7. Operate tools and libraries.

REQUIRED AND RECOMMENDED READING

[1] Graph Data Mining: Algorithm, Security and Application (Big Data Management) Graph Data Mining: Algorithm, Security and Application, Qi Xuan, Zhongyuan Ruan, Yong Min, 2021, Springer.

CSC17104 - Programming for Data Science

GENERAL INFORMATION

Course ID:	CSC17104
Course name (English):	Programming for Data Science
Course name (Vietnamese):	Lập trình cho khoa học dữ liệu
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Programming Techniques

COURSE DESCRIPTION

The course is designed to provide students with knowledge and skills about how to use data science tools: Linux commands, Git and Github, Conda, Jupyter Notebook, Markdown, Python, Matplotlib, Numpy, Pandas. We will learn these tools at a quite deep level, and we will learn them in the context of data science process: ask a meaningful question which can be answered with data, collect data, explore data, preprocess data, analyze data, communicate results.

COURSE GOALS

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

1. Use Linux commands and Conda to set up the working environment.
2. Use Python with built-in libraries to perform a data science process.
3. Use Python with the Numpy library to perform a data science process with numerical data.
4. Use Python with the Pandas library to perform a data science process with tabular data.
5. Use Python with the Matplotlib library to visualize data.
6. Use Jupyter Notebook and writing skills to document the whole data science process.
7. Use Git, Github, and teamwork skills to control versions and collaborate with others.

REQUIRED AND RECOMMENDED READING

[1] Data Science from Scratch: First Principles with Python, Joel Grus, 2019, O'Reilly Media.

CSC17105 - Introduction to Computational Thinking

GENERAL INFORMATION

Course ID:	CSC17105
Course name (English):	Introduction to Computational Thinking
Course name (Vietnamese):	Nhập môn tư duy tính toán
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course introduces computational thinking and uses the Julia programming language to approach real-world problems, especially in different fields. This is a subject that involves both data analysis and computational modeling, helping students apply skills in real-life situations. In this course, students will be introduced to computer science and algorithms, and learn how to use software to solve complex problems. Students will also learn about the applications of computational thinking in many fields, including data science, business, healthcare, and more. The course helps students gain a better understanding of mathematics and how to apply it to solve real-world problems. In addition, students also learn how to integrate skills ranging from data analysis to programming and data processing, to become a well-rounded computational thinker.

COURSE GOALS

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

1. Solve problems independently or collaborate with other team members.
2. List and explain English terminology that is related to computational thinking.
3. Discuss how computational thinking concepts and applications are used to solve real-world problems.
4. Describe the structure, distribution, and probability of components in a computational architecture.
5. Produce dynamic programming, GPU programming, and demonstrating convolutional mechanisms on data.
6. Show ability to model some components of real-world problems.
7. Use supporting software tools and programming languages.

REQUIRED AND RECOMMENDED READING

[1] Computational Thinking (The MIT Press Essential Knowledge series), Peter J. Denning, Matti Tedre, 2019, The MIT Press.

[2] Computational Thinking: A beginner's guide to problem-solving and programming, Karl Beecher, 2017, BCS, The Chartered Institute for IT.

CSC17106 - Online Analytical Processing

GENERAL INFORMATION

Course ID:	CSC17106
Course name (English):	Online Analytical Processing
Course name (Vietnamese):	Xử lý phân tích dữ liệu trực tuyến
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Data Structures and Algorithms

COURSE DESCRIPTION

Data is one of an organization's most valuable commodities. But how can organizations best use their data and how does the organization determine which data is the most recent, accurate, and useful for business decision making at the highest level. Business Intelligence has evolved from a niche area for large enterprises and organizations to an essential infrastructure for all business entities, regardless size. The ability to integrate, analyze and aggregate large amounts of data in a simple and efficient manner became a necessity in the last decade or so.

This course will allow you to learn in a very simple way how to identify, design and develop analytical information systems, such as Business Intelligence with a descriptive analysis on data warehouses. A data warehouse is a large repository of data that has been cleaned to a consistent quality. Not all data repositories are used in the same way or require the same rigor when choosing what data to store. Data warehouses are designed to enable rapid business decision making through accurate and flexible reporting and data analysis. A data warehouse is one of the most fundamental business intelligence tools in use today, and one that successful Data Engineers must understand. This course also describes different kinds of repositories including data marts, data lakes, and data reservoirs and explains their functions and uses. Students will be introduced to the problem of integration and predictive analysis of high volume of unstructured data and the definition of the Extract, Transform, Load (ETL) process as well as touch on data warehousing in the big data framework. Students will be provided insight into methods and tools for analysis and processing of the data generated by modern information systems. Besides, real-time data analytics looks at a portion of big data that deals with streaming data will be introduced in this course.

COURSE GOALS

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

1. Practice teamwork skills.
2. Practice reading technique documents in English.
3. Practice critical and creative thinking in study process.
4. Explain Business Intelligence, Analytics, and Data Science.
5. Express the different kinds of repositories including data ware house, data marts, data lakes, and data reservoirs, and explain their functions and uses.
6. Experiment the additional technologies to bring business intelligence to the big data era.

REQUIRED AND RECOMMENDED READING

[1] Business Intelligence, Analytics, and Data Science, Ramesh Sharda, Dursun Delen, Efraim Turban, 2019, Pearson.

[2] The Enterprise Big Data Lake Delivering the Promise of Big Data and Data Science (1st Edition), Alex Gorelik, 2019, O'Reilly Media.

CSC10204 - Capstone Projects

GENERAL INFORMATION

Course ID:	CSC10204
Course name (English):	Capstone Projects
Course name (Vietnamese):	Thực tập dự án tốt nghiệp
Relation to curriculum:	Specializations (elective)
Credit points:	6 credits (Theory: 0; Laboratory: 6) / ~ 12 ECTS credits
Prior course(s):	

CSC10251 - Undergraduate Thesis

GENERAL INFORMATION

Course ID:	CSC10251
Course name (English):	Undergraduate Thesis
Course name (Vietnamese):	Khóa luận tốt nghiệp
Relation to curriculum:	Specializations (elective)
Credit points:	10 credits (Theory: 0; Laboratory: 10) / ~ 20 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The thesis is one of the final courses in the program that requires students to fulfill the requirements for graduation. The course is performed in the form of thesis projects. Each project is carried out by up to two students who are expected to complete the project within 6 months. The thesis project is expected to be the culmination of students' years of undergraduate study. They need to apply all knowledge, skills, and experience gained from all courses that they have already taken to carry out work necessary to complete the thesis project. The project is also expected to be sufficiently large in size and complexity as compared with other projects taken during their undergraduate study.

The thesis project can be either research-oriented or application-oriented. In the research-oriented project, students need to propose a relevant research topic (based on recommendations of a thesis supervisor), carry out necessary research activities, write a thesis, and present the thesis in front of a thesis committee. The research work may lead to publications in a scientific conference or journal. In the application-oriented project, students in collaboration with a thesis supervisor propose and develop a software application, write a thesis to describe the application along with the process of developing it, and present the thesis in front of a thesis committee. The application should have the potential to be applied in practice and is possibly deployed for real use.

Students on each team are assessed and graded by the thesis committee using the course's predefined rubrics. They are required to meet a designated thesis reviewer to present their work and answer any questions the reviewer has. They then to present the thesis in front of the committee to defend their work. The final grade will be calculated from the grades given by the reviewer, the supervisor, and the committee members.

CSC10252 - Industrial-based Thesis

GENERAL INFORMATION

Course ID:	CSC10252
Course name (English):	Industrial-based Thesis
Course name (Vietnamese):	Thực tập tốt nghiệp
Relation to curriculum:	Specializations (elective)
Credit points:	10 credits (Theory: 0; Laboratory: 10) / ~ 20 ECTS credits
Prior course(s):	

MTH00003 - Calculus 1B

GENERAL INFORMATION

Course ID:	MTH00003
Course name (English):	Calculus 1B
Course name (Vietnamese):	Vi tích phân 1B
Relation to curriculum:	General Education (compulsory)
Credit points:	3 credits (Theory: 3; Laboratory: 0) / ~ 3 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course plays a role in providing fundamental knowledge of integral calculus for fields such as Information Technology, Electronics and Telecommunications, Physics, Oceanography and Meteorology, Materials Science, serving as a mathematical foundation for specialized subjects. The knowledge will equip students with: Real numbers; Sequences and series of real numbers; Continuity, limits, derivatives, and Riemann integration of single-variable real functions; Differential equations; The applications of Matlab for integral calculus. This course combines theoretical knowledge with practical exercises to help students develop a clear understanding and practical application of the concepts. Upon completion of the course, students will possess a solid foundation in integral calculus, the ability to solve related problems, and proficiency in utilizing Matlab for integral calculus computations.

REQUIRED AND RECOMMENDED READING

- [1] Calculus, J. Stewart, 2012.
- [2] Giáo trình Giải Tích 1, Dương Minh Đức., 2006.
- [3] Advanced engineering mathematics, K.A. Stroud and D.J. Booth, 2001.

MTH00081 - Calculus Laboratory 1B

GENERAL INFORMATION

Course ID:	MTH00081
Course name (English):	Calculus Laboratory 1B
Course name (Vietnamese):	Thực hành Vi tích phân 1B
Relation to curriculum:	General Education (compulsory)
Credit points:	1 credits (Theory: 0; Laboratory: 1) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course is the lab part of course "Calculus 1B". The knowledge will equip students with: Real numbers; Sequences and series of real numbers; Continuity, limits, derivatives, and Riemann integration of single-variable real functions; Differential equations; The applications of Matlab for integral calculus. This course combines theoretical knowledge with practical exercises to help students develop a clear understanding and practical application of the concepts. Upon completion of the course, students will possess a solid foundation in integral calculus, the ability to solve related problems, and proficiency in utilizing Matlab for integral calculus computations.

REQUIRED AND RECOMMENDED READING

- [1] Calculus, 2012.
- [2] Giáo trình Giải Tích 1, Dương Minh Đức, 2006.

MTH00004 - Calculus 2B

GENERAL INFORMATION

Course ID:	MTH00004
Course name (English):	Calculus 2B
Course name (Vietnamese):	Vi tích phân 2B
Relation to curriculum:	General Education (compulsory)
Credit points:	3 credits (Theory: 3; Laboratory: 0) / ~ 3 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course serves to provide fundamental knowledge of integral calculus for disciplines such as Information Technology, Electronics and Telecommunications, Physics, Oceanography and Meteorology, Materials Science, offering a mathematical foundation to support specialized subjects. The knowledge imparted to students includes: Set \mathbb{R}^n ; continuous real-valued functions of multiple variables; Partial derivatives; Derivatives of functions of multiple variables; Extrema; Double integration; Triple integration; Line integrals of the first and second kind; Green's theorem; Surface integrals of the first and second kind; Stokes' theorem; Gauss-Ostrogradsky theorem. Throughout the course, students will engage in theoretical discussions, problem-solving exercises, and practical applications of these concepts. By the end of the course, students will have a solid understanding of integral calculus in multiple dimensions and its applications in various disciplines.

REQUIRED AND RECOMMENDED READING

- [1] Calculus, J. Stewart, 2012.
- [2] Giáo trình Giải Tích 1, Dương Minh Đức., 2006.

MTH00082 - Calculus 2B - Practice

GENERAL INFORMATION

Course ID:	MTH00082
Course name (English):	Calculus 2B - Practice
Course name (Vietnamese):	Thực hành Vi tích phân 2B
Relation to curriculum:	General Education (compulsory)
Credit points:	1 credits (Theory: 0; Laboratory: 1) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course is the practical part of course "Calculus 2B". The knowledge imparted to students includes: Set \mathbb{R}^n ; continuous real-valued functions of multiple variables; Partial derivatives; Derivatives of functions of multiple variables; Extrema; Double integration; Triple integration; Line integrals of the first and second kind; Green's theorem; Surface integrals of the first and second kind; Stokes' theorem; Gauss-Ostrogradsky theorem. Throughout the course, students will engage in theoretical discussions, problem-solving exercises, and practical applications of these concepts. By the end of the course, students will have a solid understanding of integral calculus in multiple dimensions and its applications in various disciplines.

REQUIRED AND RECOMMENDED READING

- [1] Calculus, J. Stewart, 2012.
- [2] Giáo trình Giải Tích 1, Dương Minh Đức,, 2006.

MTH00030 - Linear Algebra

GENERAL INFORMATION

Course ID:	MTH00030
Course name (English):	Linear Algebra
Course name (Vietnamese):	Đại số tuyến tính
Relation to curriculum:	General Education (compulsory)
Credit points:	3 credits (Theory: 3; Laboratory: 0) / ~ 3 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course offers foundational material in Linear Algebra, which is essential for mathematics, engineering, and the sciences. It primarily focuses on key topics such as linear equations, matrix methods, analytical geometry, and linear transformations. Throughout the course, students can expect to:

- (1) Learn about linear equations: Students will study the theory and techniques related to solving systems of linear equations. They will explore concepts such as matrix operations, row reduction, and Gaussian elimination to solve linear equations and analyze their solutions.
- (2) Gain proficiency in matrix methods: Students will develop a strong understanding of matrices and their properties. They will learn how to perform operations on matrices, such as matrix addition, multiplication, and inversion. Additionally, they will explore applications of matrices in various fields.
- (3) Explore analytical geometry: Students will delve into the study of vectors and their geometric interpretations. They will learn about vector operations, vector spaces, and vector equations. This knowledge will provide a foundation for understanding geometric concepts and their relationship to linear algebra.
- (4) Understand linear transformations: Students will examine the concept of linear transformations and their properties. They will explore the relationship between linear transformations and matrices, as well as the applications of linear transformations.

By the end of the course, students will have a solid understanding of linear algebra concepts and their applications in mathematics, engineering, and the sciences. They will be equipped with the necessary knowledge to solve linear equations, perform matrix operations, analyze vector spaces, and comprehend the role of linear transformations. This knowledge will serve as a valuable foundation for their future studies.

REQUIRED AND RECOMMENDED READING

[1] Đại số tuyến tính và ứng dụng,

Tập 1, Bùi Xuân Hải, Trần Ngọc Hội, Trịnh Thanh Đèo, Lê Văn Luyện, 2009.

[2] Giáo trình Đại số tuyến tính, Ngô Việt Trung, 2001.

[3] Đại số tuyến tính, Nguyễn Hữu Việt Hưng, 2004.

MTH00083 - Linear Algebra - Practice

GENERAL INFORMATION

Course ID:	MTH00083
Course name (English):	Linear Algebra - Practice
Course name (Vietnamese):	Thực hành Đại số tuyến tính
Relation to curriculum:	General Education (compulsory)
Credit points:	1 credits (Theory: 0; Laboratory: 1) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course is the practical part of course "Linear Algebra". This course offers foundational material in Linear Algebra, which is essential for mathematics, engineering, and the sciences. It primarily focuses on key topics such as linear equations, matrix methods, analytical geometry, and linear transformations. By the end of the course, students will have a solid understanding of linear algebra concepts and their applications in mathematics, engineering, and the sciences. They will be equipped with the necessary knowledge to solve linear equations, perform matrix operations, analyze vector spaces, and comprehend the role of linear transformations.

REQUIRED AND RECOMMENDED READING

- [1] Đại số tuyến tính và ứng dụng, Tập 1, Bùi Xuân Hải, Trần Ngọc Hội, Trịnh Thanh Đèo, Lê Văn Luyện, 2009.
- [2] Giáo trình Đại số tuyến tính, Ngô Việt Trung, 2001.
- [3] Đại số tuyến tính, Nguyễn Hữu Việt Hưng, 2004.

MTH00040 - Applied Statistics for Engineers and Scientists

GENERAL INFORMATION

Course ID:	MTH00040
Course name (English):	Applied Statistics for Engineers and Scientists
Course name (Vietnamese):	Xác suất thống kê
Relation to curriculum:	General Education (compulsory)
Credit points:	3 credits (Theory: 3; Laboratory: 0) / ~ 3 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course covers fundamental concepts in probability, random variables, common probability distributions, confidence intervals, hypothesis testing, regression, and correlation. Throughout the course, students will explore the following topics:

(1) Basic probability concepts: Students will learn the foundations of probability theory, including the concepts of sample space, events, probability axioms, and conditional probability. They will also study important concepts such as independence, Bayes' theorem, and the law of total probability.

(2) Random variables: Students will delve into the concept of random variables, understanding discrete and continuous random variables, probability mass functions, probability density functions, cumulative distribution functions, and moments of random variables.

(3) Common probability distributions: Students will explore widely used probability distributions, such as the binomial, Poisson, normal (Gaussian), and exponential distributions. They will understand the characteristics, properties, and applications of these distributions in various fields.

(4) Confidence intervals: Students will learn how to construct confidence intervals, which provide a range of plausible values for population parameters based on sample data. They will study methods for estimating population means, proportions, and other parameters, along with the interpretation and determination of confidence levels.

(5) Hypothesis testing: Students will understand the principles of hypothesis testing, including null and alternative hypotheses, Type I and Type II errors, significance levels, and p-values. They will learn hypothesis tests for population means, proportions, and variances.

(6) Regression and correlation: Students will explore the concepts of regression and correlation analysis. They will learn how to perform simple and multiple linear regression, interpret regression coefficients, assess model fit, and analyze the strength and direction of relationships using correlation coefficients.

By the end of the course, students will have a solid understanding of basic probability concepts, random variables, common probability distributions, confidence intervals, hypothesis testing, regression, and correlation. This knowledge will enable them to analyze and interpret data, make informed decisions based on statistical evidence, and apply statistical techniques in various fields.

REQUIRED AND RECOMMENDED READING

[1] Xác suất thống kê, Nguyễn Thị Mộng Ngọc, 2018.

[2] Bài Tập và Thực Hành Xác suất thống kê, Nguyễn Thị Mộng Ngọc, 2018.

[3] Giáo trình lý thuyết xác suất và thống kê toán. Bài tập Lý thuyết xác suất và thống kê toán, Trần Tuấn Điệp, Lý Hoàng Tú, 1979.

MTH00085 - Statistics - Practice

GENERAL INFORMATION

Course ID:	MTH00085
Course name (English):	Statistics - Practice
Course name (Vietnamese):	Thực hành Xác suất thống kê
Relation to curriculum:	General Education (compulsory)
Credit points:	1 credits (Theory: 0; Laboratory: 1) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course is the practical part of course "Applied Statistics for Engineers and Scientists". This course covers fundamental concepts in probability, random variables, common probability distributions, confidence intervals, hypothesis testing, regression, and correlation. This knowledge will enable them to analyze and interpret data, make informed decisions based on statistical evidence, and apply statistical techniques in various fields.

REQUIRED AND RECOMMENDED READING

- [1] Xác suất thống kê, Nguyễn Thị Mộng Ngọc, 2018.
- [2] Bài Tập và Thực Hành Xác suất thống kê, Nguyễn Thị Mộng Ngọc, 2018.
- [3] Giáo trình lý thuyết xác suất và thống kê toán. Bài tập Lý thuyết xác suất và thống kê toán, Trần Tuấn Điệp, Lý Hoàng Tú, 1979.

MTH00041 - Discrete Mathematics

GENERAL INFORMATION

Course ID:	MTH00041
Course name (English):	Discrete Mathematics
Course name (Vietnamese):	Toán rời rạc
Relation to curriculum:	General Education (compulsory)
Credit points:	3 credits (Theory: 3; Laboratory: 0) / ~ 3 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

Discrete Mathematics is a foundational course that explores fundamental mathematical concepts and structures essential to various fields, including computer science, information technology, and engineering. This course provides students with the necessary tools to analyze and solve problems using discrete mathematical techniques. Throughout the course, students will delve into a wide range of topics, including:

(1) Logic: Students will learn the principles of propositional logic and predicate logic. They will explore logical connectives, truth tables, logical equivalences, and methods of proof, enabling them to construct and analyze logical arguments.

(2) Sets and Relations: Students will study set theory, including operations on sets, set identities, and properties. They will also investigate various types of relations, such as equivalence relations and partial orders, and explore functions and their properties.

(3) Combinatorics: Students will explore counting principles and combinatorial techniques. They will learn about permutations, combinations, binomial coefficients, and the inclusion-exclusion principle. These concepts are fundamental for analyzing the number of possible outcomes in various scenarios.

(4) Graph Theory: Students will delve into graph theory, examining the properties and applications of graphs. They will learn about graph representations, connectivity, graph coloring, Eulerian and Hamiltonian paths, and spanning trees. Graph theory provides a powerful framework for solving problems in network design, optimization, and algorithm analysis.

Discrete Mathematics is a crucial course for students in disciplines such as computer science, information technology, and engineering, as it lays the groundwork for further studies in areas like algorithms, data structures, cryptography, and artificial intelligence.

REQUIRED AND RECOMMENDED READING

- [1] Toán rời rạc, Nguyễn Hữu Anh, 1999.
- [2] Discrete mathematics and its application, Kenneth h. Rosen., 2012.
- [3] Discrete mathematics, Richard johnsonbaugh, 2005.

MTH00086 - Discrete Mathematics - Practice

GENERAL INFORMATION

Course ID:	MTH00086
Course name (English):	Discrete Mathematics - Practice
Course name (Vietnamese):	Thực hành Toán rời rạc
Relation to curriculum:	General Education (compulsory)
Credit points:	1 credits (Theory: 0; Laboratory: 1) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course is the practical part of course "Discrete Mathematics". This course provides students with the necessary tools to analyze and solve problems using discrete mathematical techniques. Throughout the course, students will delve into a wide range of topics, including: (1) logic; (2) sets and relations; (3) combinatorics; (4) graph theory.

MTH00050 - Combinatorial Mathematics

GENERAL INFORMATION

Course ID:	MTH00050
Course name (English):	Combinatorial Mathematics
Course name (Vietnamese):	Toán học tổ hợp
Relation to curriculum:	General Education (compulsory)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Programming Techniques

COURSE DESCRIPTION

This course aims to provide students with knowledge of graph theory and combinatorics. In the graph theory section, students will be introduced to fundamental concepts such as undirected graphs, directed graphs, paths, cycles, vertex degrees, isomorphic graphs, and more. Additionally, students will learn about trees, tree traversal algorithms, and algorithms for solving problems like finding the minimum spanning tree and shortest path. In the combinatorics section, students will learn advanced counting techniques such as generating functions, the principle of inclusion-exclusion, polynomial of rooks, and their application to complex counting problems. The course also introduces some advanced counting principles like Catalan numbers, Stirling numbers, and Bell numbers.

COURSE GOALS

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

1. Explain the concepts of graphs and apply them to solve basic graph problems.
2. Apply the learned algorithms to solve various tree-related problems.
3. Explain and solve problems related to path finding on graphs.
4. Use combinatorial theory to solve counting problems.
5. Construct generating functions and use them to solve counting problems.
6. Apply the principle of inclusion-exclusion and the polynomial of rooks to solve counting problems.
7. Explain the definitions of some advanced counting principles.

REQUIRED AND RECOMMENDED READING

- [1] Applied Combinatorics 6th edition, Alan Tucker, 2012, JohnWiley & Sons, Inc.
- [2] Toán rời rạc nâng cao, Trần Ngọc Danh, 2001, NXB ĐHQG-TPHCM.
- [3] Introduction to Combinatorics, Walter D. Wallis, John C. George, 2017, Chapman and Hall/CRC.

MTH00051 - Applied Mathematics and Statistics

GENERAL INFORMATION

Course ID:	MTH00051
Course name (English):	Applied Mathematics and Statistics
Course name (Vietnamese):	Toán ứng dụng và thống kê
Relation to curriculum:	General Education (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

In the first three semesters of university, students acquire foundational mathematical knowledge in calculus, linear algebra, and probability-statistics. This knowledge forms the basis for further studies in various disciplines. To enhance their problem-solving abilities in data analysis, students will be introduced to algorithmic skills. The course is organized into three blocks of knowledge: computational methods for matrix algebra, computational methods for convex optimization, and probability models. Throughout the course, students will engage in practical exercises, assignments, and projects that involve implementing algorithms, solving mathematical problems, and analyzing real-world datasets. They will acquire algorithmic skills to tackle data analysis problems and gain a deeper understanding of computational methods in matrix algebra, convex optimization, and probability models. By the end of the course, students will have a solid foundation in mathematical concepts from calculus, linear algebra, and probability-statistics, along with the ability to apply computational methods to solve problems in data analysis. They will possess the skills necessary to analyze complex datasets, develop mathematical models, and make data-driven decisions in various fields, including computer science, engineering, and statistics.

COURSE GOALS

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

1. Apply team work and individual skills.
2. Explain terminologies in data science.
3. Explain terminologies in computer science.
4. Define applied mathematical problems.
5. Apply math knowledge to solve CS problems.
6. Apply Python programming.

REQUIRED AND RECOMMENDED READING

[1] Cơ sở Toán cho Khoa học dữ liệu, Nguyễn Thanh Bình, Đinh Ngọc Thanh, Nguyễn Đình Thúc, 2022, NXB ĐHQG TPHCM.

MTH00052 - Numerical Analysis

GENERAL INFORMATION

Course ID:	MTH00052
Course name (English):	Numerical Analysis
Course name (Vietnamese):	Phương pháp tính
Relation to curriculum:	General Education (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

MTH00053 - Number Theory

GENERAL INFORMATION

Course ID:	MTH00053
Course name (English):	Number Theory
Course name (Vietnamese):	Lý thuyết số
Relation to curriculum:	General Education (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

Number Theory is a fascinating branch of mathematics that explores the properties and relationships of integers and their patterns. This course provides students with an in-depth understanding of the fundamental concepts and theories in number theory, equipping them with analytical skills to solve complex problems and make significant contributions to the field. Throughout the course, students will explore the following key topics: (1) Divisibility and Congruence; (2) Prime Numbers and Factorization; (3) Diophantine Equations; (4) Prime Number Theorem and Distribution of Primes; (5) Cryptography and Number-Theoretic Algorithms. Throughout the course, students will engage in problem-solving exercises, proofs, and theoretical discussions to deepen their understanding of number theory concepts. They will develop critical thinking, analytical reasoning, and abstract reasoning skills, which are valuable in various fields, including cryptography, computer science, and mathematical research. By the end of the course, students will have a solid foundation in number theory and the ability to apply mathematical principles to solve complex problems. They will have gained insights into the beauty and elegance of number theory, as well as its practical applications in cryptography, algorithms, and other areas of mathematics.

MTH00054 - Predicate Calculus

GENERAL INFORMATION

Course ID:	MTH00054
Course name (English):	Predicate Calculus
Course name (Vietnamese):	Phép tính vị từ
Relation to curriculum:	General Education (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

MTH00056 - Mathematics for Artificial Intelligence

GENERAL INFORMATION

Course ID:	MTH00056
Course name (English):	Mathematics for Artificial Intelligence
Course name (Vietnamese):	Phương pháp toán cho trí tuệ nhân tạo
Relation to curriculum:	General Education (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course is designed to provide students (i) Discrete structure, especially graph theory and algorithms related to optimal search; and (ii) Mathematical models.

Specifically, the course focuses on three basic models: optimal models, dynamical models, and probabilistic models.

COURSE GOALS

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

1. Understand the relevant basic math knowledge to AI.
2. Use math methods for AI.
3. Understand and use discrete structures: combinatorics, graphs.
4. Understand and develop function optimal models.
5. Understand and develop dynamical models.
6. Understand and develop probabilistic models.

REQUIRED AND RECOMMENDED READING

[1] Mathematics for Machine Learning, Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, 2021, CAMBRIDGE UNIVERSITY PRESS.

PHY00001 - General Physics 1 (Mechanics - Thermodynamics)

GENERAL INFORMATION

Course ID:	PHY00001
Course name (English):	General Physics 1 (Mechanics - Thermodynamics)
Course name (Vietnamese):	Vật lý đại cương 1 (Cơ - Nhiệt)
Relation to curriculum:	General Education (elective)
Credit points:	3 credits (Theory: 3; Laboratory: 0) / ~ 3 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course provides students with a basic understanding of different forms of motion, the laws of motion for particles and other objects, and the principles of thermodynamics. It equips students with knowledge of kinetic theory and the application of conservation laws in mechanics. Students will also learn about ideal gas laws, the first and second laws of thermodynamics. The course serves as a foundational knowledge for disciplines such as Physics, Oceanography, Nuclear Engineering, and other scientific fields, preparing students for more advanced courses in subsequent years. Additionally, it helps students develop fundamental problem-solving skills applicable to both scientific and everyday life situations.

REQUIRED AND RECOMMENDED READING

- [1] Các bài giảng cơ và nhiệt, Nguyễn Nhật Khanh, 2005, NXB ĐHQG-HCM.
- [2] Vật lý đại cương 1 (Cơ và Nhiệt), Nguyễn Thành Ván, 2013, NXB ĐHQG-HCM.
- [3] Physics for Scientists and Engineers with Modern Physics, Raymond A. Serway, John W. Jewett, Sr, 2014.
- [4] Physics, Alan Giambattista, Betty McCarthy Richardson, Robert C. Richardson, 2010.

PHY00002 - General Physics 2 (Electromagnetic - Optics)

GENERAL INFORMATION

Course ID:	PHY00002
Course name (English):	General Physics 2 (Electromagnetic - Optics)
Course name (Vietnamese):	Vật lý đại cương 2 (Điện từ - Quang)
Relation to curriculum:	General Education (elective)
Credit points:	3 credits (Theory: 3; Laboratory: 0) / ~ 3 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course provides basic knowledge of electric fields, magnetic fields, and enables understanding of the laws and phenomena of optics and light. Students will learn and apply the laws governing the interaction between charged particles and the interaction between electric currents. They will also understand and apply the fundamental laws related to electric currents in circuits. Additionally, students will be able to explain and apply the phenomena of interference, diffraction, and polarization of light. The course also helps students develop fundamental problem-solving skills applicable to both scientific and everyday life situations.

REQUIRED AND RECOMMENDED READING

- [1] Vật lý đại cương 2, Nguyễn Thành Vấn, 2015, NXB ĐHQG-HCM.
- [2] Quang học, Lê Vũ Tuấn Hùng, 2015, NXB ĐHQG-HCM.
- [3] Physics for Scientists and Engineers with Modern Physics, Raymond A. Serway, John W. Jewett, Sr, 2014.
- [4] Physics, Alan Giambattista, Betty McCarthy Richardson, Robert C. Richardson, 2010.

PHY00081 - General Physics Laboratory

GENERAL INFORMATION

Course ID:	PHY00081
Course name (English):	General Physics Laboratory
Course name (Vietnamese):	Thực hành Vật lý đại cương
Relation to curriculum:	General Education (elective)
Credit points:	2 credits (Theory: 0; Laboratory: 2) / ~ 4 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This is a laboratory practical course where students will gain an understanding of concepts and theories related to experimental errors, density and specific gravity, viscosity of solutions, measuring gravitational acceleration using a pendulum, verifying Malus' law on light polarization, studying light scattering, measuring phase transition and heat capacity of metals, and understanding the construction of voltmeters and ammeters. Students will be equipped with practical skills, including the use of laboratory equipment and tools, data analysis, and report presentation. They will work in small groups of 2-3 students, which will help them develop teamwork and group discussion skills. Students will be responsible for writing experimental reports and answering prepared questions during the course.

REQUIRED AND RECOMMENDED READING

- [1] Giáo trình thực tập vật lý đại cương 1, Đặng Văn Liệt, Đỗ Đình Luyện, Nguyễn Văn Nghĩa, Trần Thị Kim Phượng, Lưu hành nội bộ.
- [2] Vật lý đại cương: tập I: cơ - nhiệt, Lương Duyên Bình, 1995, NXB Giáo dục.
- [3] Vật lý đại cương: tập II: quang học - cơ học lượng tử - vật lý hạt nhân, Cao Long Vân, 2008, NXB Giáo dục.
- [4] Vật lý đại cương: tập III: phần I: quang học - vật lý nguyên tử và hạt nhân, Lương Duyên Bình, 1998, NXB Giáo dục.
- [5] Vật lý đại cương: điện - dao động sóng, Dư Trí Công, Nguyễn Hữu Hồ, Lương Duyên Bình, 1998, NXB Giáo dục.

CHE00001 - General Chemistry 1

GENERAL INFORMATION

Course ID:	CHE00001
Course name (English):	General Chemistry 1
Course name (Vietnamese):	Hóa đại cương 1
Relation to curriculum:	General Education (elective)
Credit points:	2 credits (Theory: 2; Laboratory: 0) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course is the first chemistry course in the undergraduate program for students in natural science fields. The course covers the fundamental theoretical principles of chemistry related to basic models of atomic structure, the periodic table and chemical element properties, the fundamental forces of interaction in matter, and their influence on the properties of matter in solid, liquid, gas, and solution states.

REQUIRED AND RECOMMENDED READING

- [1] General Chemistry, Petrucci, R.H; Harwood, W.S; Herring, F.G, 2011, USA: Prentice Hall.
- [2] Tóm tắt bài giảng Hóa Đại Cương, Lê Thị Sở Như, Tài liệu nội bộ, chưa xuất bản.

CHE00081 - General Chemistry Laboratory 1

GENERAL INFORMATION

Course ID:	CHE00081
Course name (English):	General Chemistry Laboratory 1
Course name (Vietnamese):	Thực hành Hóa đại cương 1
Relation to curriculum:	General Education (elective)
Credit points:	2 credits (Theory: 0; Laboratory: 2) / ~ 4 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course "General Chemistry Laboratory 1" is the practical component that accompanies the theoretical course of General Chemistry. It is designed for students majoring in Chemistry and related fields. The objective of this course is to help students develop practical skills in using basic laboratory tools and equipment. Through practical experiments, students will have the opportunity to validate the theoretical concepts of general chemistry. They will be trained in experiment preparation, proper experimental procedures, accurate data recording, and scientific presentation of results.

REQUIRED AND RECOMMENDED READING

- [1] Giáo trình thực hành Hóa đại cương 1. Tp HMC: ĐHQG Tp HCM, Hoàng Ngọc Cường, 2016, Tài liệu lưu hành nội bộ.
- [2] Bài tường trình thực hành Hóa đại cương 1. Tp HMC: ĐHQG Tp HCM, Hoàng Ngọc Cường, 2016, Tài liệu lưu hành nội bộ.

CHE00002 - General Chemistry 2

GENERAL INFORMATION

Course ID:	CHE00002
Course name (English):	General Chemistry 2
Course name (Vietnamese):	Hóa đại cương 2
Relation to curriculum:	General Education (elective)
Credit points:	2 credits (Theory: 2; Laboratory: 0) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course aims to provide first-year students in natural science fields with fundamental knowledge of chemical processes, the role and contributions of chemistry in everyday life, as well as the interrelationship between chemistry and other scientific disciplines such as physics, biology, and environmental science. The course covers the following topics: The thermodynamic effects accompanying chemical and physical transformations. Conditions for natural occurrence of reactions and chemical equilibrium. Chemical equilibrium and factors affecting chemical equilibrium. Reaction rates and factors influencing reaction rates. Types of equilibrium in solutions: acid-base, precipitation, complex formation, and oxidation-reduction. Electrochemical cells, predicting the direction of oxidation-reduction reactions, and natural corrosion processes.

REQUIRED AND RECOMMENDED READING

- [1] General Chemistry, Principles and Modern Applications, 10nd Edition, Ralph H. Petrucci, F. G. Herring, J. Madura, C. Bissonette, 2011, Pearson Canada.
- [2] Tóm tắt bài giảng Hóa Đại Cương, Nguyễn Công Tránh, tài liệu nội bộ, chưa xuất bản.

CHE00082 - General Chemistry Laboratory 2

GENERAL INFORMATION

Course ID:	CHE00082
Course name (English):	General Chemistry Laboratory 2
Course name (Vietnamese):	Thực hành Hóa đại cương 2
Relation to curriculum:	General Education (elective)
Credit points:	2 credits (Theory: 0; Laboratory: 2) / ~ 4 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course "General Chemistry Internship 2" is the practical component that accompanies the theoretical course of General Chemistry. It is designed for students who are not majoring in Chemistry but have related fields, mainly those who do not have a deep practical focus on organic and inorganic chemistry. The objective of this course is to help students develop practical skills in using basic laboratory tools and equipment. Through practical experiments, students will have the opportunity to validate the theoretical concepts of general chemistry. They will be able to synthesize some inorganic and organic compounds in the laboratory. Students will be trained in experiment preparation, proper experimental procedures, accurate data recording, and scientific presentation of results.

REQUIRED AND RECOMMENDED READING

- [1] Giáo trình thực tập Hóa đại cương 2. Tp HCM: ĐHQG Tp HCM, Hoàng Ngọc Cường, 2016, Tài liệu lưu hành nội bộ.
- [2] Bài tường trình thực tập Hóa đại cương 2. Tp HCM: ĐHQG Tp HCM, Hoàng Ngọc Cường, 2016, Tài liệu lưu hành nội bộ.

BIO00001 - Biology 1

GENERAL INFORMATION

Course ID:	BIO00001
Course name (English):	Biology 1
Course name (Vietnamese):	Sinh đại cương 1
Relation to curriculum:	General Education (elective)
Credit points:	3 credits (Theory: 3; Laboratory: 0) / ~ 3 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course provides students with a general overview of fundamental concepts in biology, with a focus on the morphology and function of plants and animals, as well as the interactions between organisms and their environment.

REQUIRED AND RECOMMENDED READING

- [1] SINH HỌC ĐẠI CƯƠNG: Tế bào học, Di truyền học và Học thuyết Tiến hóa, Phạm Thành Hồ, 2011, Nhà Xuất Bản Đại học Quốc Gia TP. Hồ Chí Minh.
- [2] Sinh học tế bào, Bùi Trang Việt, 2012, Nhà Xuất Bản Đại học Quốc Gia TP. Hồ Chí Minh.
- [3] Campbell biology (10th edition), Reece J. B., Urry, L. A., Cain M. L. 1., Wasserman S. A., Minorsky P. V., Jackson R.B., & Campbell N. A., 2014, Pearson.

BIO00081 - Biology Laboratory 1

GENERAL INFORMATION

Course ID:	BIO00081
Course name (English):	Biology Laboratory 1
Course name (Vietnamese):	Thực tập Sinh đại cương 1
Relation to curriculum:	General Education (elective)
Credit points:	1 credits (Theory: 0; Laboratory: 1) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This is the first practical course in biology, aiming to equip students with basic knowledge of laboratory practices in biology. The course focuses on the following skills: (1) Using light microscopes to observe and describe the basic structure of cells and some fundamental life processes; (2) Performing reactions to observe and identify the chemical components of cells and some basic life processes in organisms; (3) Recognizing and distinguishing different groups of animals, plants, and microorganisms; (4) Providing knowledge of laboratory safety in general biology settings.

REQUIRED AND RECOMMENDED READING

- [1] Thực tập Sinh học Đại cương 1, Bùi Trang Việt, Lê Thị Mỹ Phước, 2016, Tủ sách Đại học Khoa học Tự nhiên.
- [2] Laboratory investigations for biology (2 edition), Dickey Jean, 2003, The Benjamin/Cummings.
- [3] Sinh học Đại cương, Phạm Thành Hồ, 2011, Tủ sách Đại học Khoa học Tự nhiên.
- [4] Sinh học Tế bào, Bùi Trang Việt, 2013, Nhà xuất bản Đại học Quốc Gia TP Hồ Chí Minh.

BIO00002 - Biology 2

GENERAL INFORMATION

Course ID:	BIO00002
Course name (English):	Biology 2
Course name (Vietnamese):	Sinh đại cương 2
Relation to curriculum:	General Education (elective)
Credit points:	3 credits (Theory: 3; Laboratory: 0) / ~ 3 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course provides students with a general overview of fundamental concepts in biology, with a focus on the morphology and function of plants and animals, as well as the interactions between organisms and their environment.

REQUIRED AND RECOMMENDED READING

- [1] Ecology: Individuals, Populations and Communities, Begon M., J.L. Harper, and C.R. Townsend, 1986, Blackwell Scientific Publications.
- [2] Biology, Brooker, R.J, Widmaier E.P; Graham L.E and Stiling P.D., 2014, McGraw-Hill.
- [3] Biology (10th Edition), Campbell N.A, J.B. Reece, L.A. Urry, M.I. Cain, S.A. Wasserman, P.V. Minorsky, and R. B. Jackson, 2014, Pearson, Benjamin Cummings.
- [4] Ecology: Theories and Applications (Fourth Edition), Stiling P. D., 2002, Prentice-Hall, Inc.
- [5] Plant biology, Smith A.M; Coupland G; Dolan L; Harberd N; Jones J; Martin C; Sablowski R; and Amey A., 2010, Garland Science.

BIO00082 - Biology Laboratory 2

GENERAL INFORMATION

Course ID:	BIO00082
Course name (English):	Biology Laboratory 2
Course name (Vietnamese):	Thực tập Sinh đại cương 2
Relation to curriculum:	General Education (elective)
Credit points:	1 credits (Theory: 0; Laboratory: 1) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course is designed to include illustrative experiments for the topics that students learn in General Biology 2. This forms the foundational knowledge for future scientific research in biology and biotechnology.

REQUIRED AND RECOMMENDED READING

[1] Giáo trình thực tập Sinh học đại cương II, Bùi Trang Việt và Phan Ngô Hoang, 2009, Trường ĐH KHTN – ĐHQG-HCM.

ENV00001 - Environmental Science

GENERAL INFORMATION

Course ID:	ENV00001
Course name (English):	Environmental Science
Course name (Vietnamese):	Môi trường đại cương
Relation to curriculum:	General Education (elective)
Credit points:	2 credits (Theory: 2; Laboratory: 0) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course introduces students to a comprehensive understanding of the Earth, including its internal and external components. It covers various aspects such as the Earth's position and its operation in space, the composition and structure of the atmosphere, wind and weather patterns, climate, climate change, the distribution of freshwater in the hydrosphere, the functioning of oceans and seas, and phenomena like El Niño and La Niña. The course also explores the Earth's geosphere, including the composition and structure of the Earth's crust, plate tectonics, erosion and deposition processes, landslides, the internal structure of the Earth, earthquakes, volcanoes, and tectonic activities. Additionally, it delves into the study of Earth's history through the examination of fossil records. Understanding Earth Science is essential for gaining insights into the natural environment of our planet and its intricate systems. It provides a foundation for comprehending the Earth's complex processes and phenomena, contributing to a broader understanding of our natural world.

REQUIRED AND RECOMMENDED READING

- [1] Bài giảng Môi trường đại cương, nhóm Giảng viên biên soạn.
- [2] Khoa học Môi trường, Lê Văn Khoa (chủ biên), 2004, NXB Giáo dục.
- [3] Giáo trình Con người và môi trường, Lê Văn Khoa, Đoàn Văn Cảnh, Nguyễn Quang Hùng, Lâm Minh Triết, 2011, NXB Giáo dục.
- [4] The Human Impact on Natural Environment, 6th Edition, Goudie, A., 2006, Oxford Blackwell.
- [5] Giáo trình Môi trường và Con người, Lê Thị Thanh Mai, 2008, NXB ĐHQG-HCM.

ENV00003 - Human and Environment

GENERAL INFORMATION

Course ID:	ENV00003
Course name (English):	Human and Environment
Course name (Vietnamese):	Con người và môi trường
Relation to curriculum:	General Education (elective)
Credit points:	2 credits (Theory: 2; Laboratory: 0) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course focuses on exploring the relationship between humans and nature. It equips students with knowledge about nature, the role of humans on Earth, and a deep understanding of the significance of nature in human life and its impact on social relationships between individuals.

REQUIRED AND RECOMMENDED READING

- [1] Con người và môi trường, Phạm Xuân Hậu, 1997, NXB Giáo dục.
- [2] Khoa học môi trường, Lê Văn Khoa (chủ biên), 2002, NXB Giáo dục.
- [3] Sinh thái học người, Nguyễn Hữu Nhân, Hoàng Quý Tình, 2011, NXB Giáo dục.
- [4] Tiếng kêu cứu của trái đất, Nguyễn Phước Trương, 1999, NXB Giáo dục.

GEO00002 - Earth Science

GENERAL INFORMATION

Course ID:	GEO00002
Course name (English):	Earth Science
Course name (Vietnamese):	Khoa học Trái đất
Relation to curriculum:	General Education (elective)
Credit points:	2 credits (Theory: 2; Laboratory: 0) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course introduces students to a comprehensive understanding of the Earth, including its internal and external components. It covers various aspects such as the Earth's position and its operation in space, the composition and structure of the atmosphere, wind and weather patterns, climate, climate change, the distribution of freshwater in the hydrosphere, the functioning of oceans and seas, and phenomena like El Niño and La Niña. The course also explores the Earth's geosphere, including the composition and structure of the Earth's crust, plate tectonics, erosion and deposition processes, landslides, the internal structure of the Earth, earthquakes, volcanoes, and tectonic activities. Additionally, it delves into the study of Earth's history through the examination of fossil records. Understanding Earth Science is essential for gaining insights into the natural environment of our planet and its intricate systems. It provides a foundation for comprehending the Earth's complex processes and phenomena, contributing to a broader understanding of our natural world.

REQUIRED AND RECOMMENDED READING

- [1] Earth Science, DANIELSON, E.W., DENECKE, E.J.Jr., 1986.
- [2] Foundations of Earth Science, Lutgens Frederick K, Tarbuck Edward J, 1997.
- [3] Giáo trình Khoa học Trái đất, LƯU ĐỨC HẢI, TRẦN NGHI, 2008.
- [4] Earth Science Today, MURPHY, B., NANCE, D., 1999.
- [5] An introduction to the earth-life system, Cockell Charles, 2008.

BAA00003 - Ho Chi Minh's Ideology

GENERAL INFORMATION

Course ID:	BAA00003
Course name (English):	Ho Chi Minh's Ideology
Course name (Vietnamese):	Tư tưởng Hồ Chí Minh
Relation to curriculum:	General Education (compulsory)
Credit points:	2 credits (Theory: 2; Laboratory: 0) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course provides students with fundamental knowledge about: the research subjects, research methods, and the significance of studying Ho Chi Minh's ideology; the foundation, formation, and development process of Ho Chi Minh's ideology; national independence and socialism; the Communist Party and the Vietnamese State; national unity and international solidarity; culture, ethics, and human values.

REQUIRED AND RECOMMENDED READING

[1] Tư tưởng Hồ Chí Minh, Bộ Giáo dục và Đào tạo, 2019, Nxb. Chính trị quốc gia, Hà Nội.

BAA00004 - Introduction to Law

GENERAL INFORMATION

Course ID:	BAA00004
Course name (English):	Introduction to Law
Course name (Vietnamese):	Pháp luật đại cương
Relation to curriculum:	General Education (compulsory)
Credit points:	3 credits (Theory: 3; Laboratory: 0) / ~ 3 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course provides students with fundamental knowledge about the state and law, as well as the state apparatus and the legal system of Vietnam at present. It also equips students with basic knowledge related to anti-corruption laws, thereby enhancing their awareness of living, studying, and working in accordance with the Constitution and laws. Additionally, the course aims to develop students' awareness of anti-corruption in society.

REQUIRED AND RECOMMENDED READING

[1] Pháp luật đại cương, Tập thể tác giả Trường Đại học Luật TP.HCM, 2019.

BAA00005 - Introduction to Economics

GENERAL INFORMATION

Course ID:	BAA00005
Course name (English):	Introduction to Economics
Course name (Vietnamese):	Kinh tế đại cương
Relation to curriculum:	General Education (elective)
Credit points:	2 credits (Theory: 2; Laboratory: 0) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course presents basic issues in economics, principles of economics, supply and demand models, and market equilibrium. It also covers theories of consumer behavior and firm behavior, types of markets, aggregate supply and demand, and measures of national output.

REQUIRED AND RECOMMENDED READING

- [1] Nguyên lý kinh tế học [Principles of economics] (2nd edn). New York: Worth Publisher., Mankiw, N.G, 2003, Bản dịch của Khoa Kinh Tế Học, Trường Đại Học Kinh Tế Quốc Dân. NXB Thống Kê.
- [2] Kinh tế học vi mô, Giáo trình dùng trong các trường đại học, cao đẳng khối Kinh tế., 2003, NXB Giáo Dục.
- [3] Kinh tế học vĩ mô, Giáo trình dùng trong các trường đại học, cao đẳng khối Kinh tế., 2002, NXB Giáo Dục.

BAA00006 - Introduction to Psychology

GENERAL INFORMATION

Course ID:	BAA00006
Course name (English):	Introduction to Psychology
Course name (Vietnamese):	Tâm lý đại cương
Relation to curriculum:	General Education (elective)
Credit points:	2 credits (Theory: 2; Laboratory: 0) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The General Psychology course provides students with the most fundamental knowledge about the psychological aspects of human life. Based on this foundation, students can apply it to solve emerging issues in their daily lives as well as in their future professional activities.

REQUIRED AND RECOMMENDED READING

- [1] Đề cương bài giảng môn Tâm lý học đại cương, Phạm Văn Dinh, Lê Văn Bích, Đại học Luật, Tp.HCM.
- [2] Giáo trình tâm lý học đại cương, Đặng Thanh Nga (Chủ biên), 2006, NXB Công an nhân dân, Hà Nội.
- [3] Giáo trình tâm lý học đại cương, Nguyễn Quang Uẩn (Chủ biên), 2005, NXB Đại học sư phạm, Hà Nội.

BAA00007 - Creativity Methodologies

GENERAL INFORMATION

Course ID:	BAA00007
Course name (English):	Creativity Methodologies
Course name (Vietnamese):	Phương pháp luận sáng tạo
Relation to curriculum:	General Education (elective)
Credit points:	2 credits (Theory: 2; Laboratory: 0) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course aims to equip students with a system of advanced creative thinking methods and skills, which are taught in many companies and universities worldwide to develop innovative human resources. In the knowledge-based era, individuals are required to work with their minds to effectively solve problems and make correct decisions. The course covers topics of: Natural methods for problem-solving and decision-making - Overview of PPLST-TRIZ approaches; Some scientific and technical knowledge as the foundation of the course; Basic creative techniques; Methods for enhancing creative thinking; etc.

REQUIRED AND RECOMMENDED READING

[1] Giáo trình tóm tắt: phương pháp luận sáng tạo khoa học - kỹ thuật giải quyết vấn đề và ra quyết định (chương trình sơ cấp)., Phan Dũng, 2000.

BAA00011 - General English 1

GENERAL INFORMATION

Course ID:	BAA00011
Course name (English):	General English 1
Course name (Vietnamese):	Anh văn 1
Relation to curriculum:	General Education (compulsory)
Credit points:	3 credits (Theory: 2; Laboratory: 1) / ~ 4 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course aims to achieve the following objectives and main content: a. Develop and enhance basic listening, speaking, reading, and writing skills to reach level A1 and have the ability to continue studying at level A2. b. Familiarize learners with the question formats of the VNU-EPT exam, focusing on appropriate time allocation, language emphasis, and skill requirements of the A1 level. c. The skills developed can serve as a foundation for learners to prepare for standardized international exams such as IELTS, TOEIC, etc. d. Enable learners to self-study to reinforce and improve their skills and knowledge, using additional materials provided by the teacher, such as Workbooks, Mini-Dictionary, Consolidation, Study Practice Remember, Mini-check, Language summary, or Task-based Activities accompanying each module.

REQUIRED AND RECOMMENDED READING

[1] NEW CUTTING EDGE Pre-Intermediate (Modules 1 – 8).

BAA00012 - General English 2

GENERAL INFORMATION

Course ID:	BAA00012
Course name (English):	General English 2
Course name (Vietnamese):	Anh văn 2
Relation to curriculum:	General Education (compulsory)
Credit points:	3 credits (Theory: 2; Laboratory: 1) / ~ 4 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course has the following objectives and main content: a) Consolidate and improve the fundamental skills of listening, speaking, reading, and writing to reach level A2 and have the ability to continue studying at level A3. b) Further enhance the ability to meet the requirements of the VNU-EPT exam and approach the lower intermediate level of standardized exams such as IELTS, TOEIC, etc. c) Continuously improve learning skills and the ability to self-study to reinforce and enhance skills and knowledge, using additional materials provided by the teacher, reference materials, Workbooks, Mini-Dictionary, Consolidation, Study Practice Remember, Mini-check, Language summary, or Task-based Activities accompanying each module.

REQUIRED AND RECOMMENDED READING

[1] NEW CUTTING EDGE Pre-Intermediate (Modules 9 – 15).

BAA00013 - Academic English 1

GENERAL INFORMATION

Course ID:	BAA00013
Course name (English):	Academic English 1
Course name (Vietnamese):	Anh văn 3
Relation to curriculum:	General Education (compulsory)
Credit points:	3 credits (Theory: 2; Laboratory: 1) / ~ 4 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course has the following objectives and main content: a) Students begin at the Intermediate level with the skills of listening, speaking, reading, writing, and intermediate-level grammar and vocabulary to reach level A3 and have the ability to continue studying at level A4. b) Students continue to enhance their ability to write paragraphs, listen to and read more comprehensive topics, and communicate with more complex skills such as arguing, refuting, or supporting an argument, etc. c) The developed skills can help students confidently prepare for standardized exams or the VNU-EPT exam, etc.

REQUIRED AND RECOMMENDED READING

[1] NEW CUTTING EDGE Intermediate (Modules 1 – 6).

BAA00014 - Academic English 2

GENERAL INFORMATION

Course ID:	BAA00014
Course name (English):	Academic English 2
Course name (Vietnamese):	Anh văn 4
Relation to curriculum:	General Education (compulsory)
Credit points:	3 credits (Theory: 2; Laboratory: 1) / ~ 4 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course has the following objectives and main content: a) Students will approach the upper level of Lower Intermediate with the skills of listening, speaking, reading, writing, and sufficient grammar and vocabulary knowledge to prepare for the VNU-EPT exam and other standardized exams. b) Students will continue to improve their ability to write paragraphs, listen to and read more comprehensive topics, and communicate with more complex skills such as negotiating, opposing, or supporting an argument, etc. c) The developed skills can help students confidently participate in standardized exams or the VNU-EPT exam, etc.

REQUIRED AND RECOMMENDED READING

[1] NEW CUTTING EDGE Intermediate (Modules 7 – 12).

BAA00021 - Physical Education I

GENERAL INFORMATION

Course ID:	BAA00021
Course name (English):	Physical Education I
Course name (Vietnamese):	Thể dục 1
Relation to curriculum:	General Education (compulsory)
Credit points:	2 credits (Theory: 1; Laboratory: 1) / ~ 3 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course provides students with fundamental knowledge about the benefits and roles of physical exercise and sports, as well as the ability to apply knowledge and skills to engage in daily exercise for maintaining and improving health and preventing diseases. The course content includes: The effects of physical exercise and sports on body development and the role of Physical Education in the comprehensive development of individuals; A brief overview of the history and impact of the sport of volleyball; Volleyball game rules.

REQUIRED AND RECOMMENDED READING

[1] Tài liệu giảng dạy Thể dục thể thao. Tập 1,2,3, Nxb Đại học và Trung học chuyên nghiệp, Hà Nội, Bộ Đại học và Trung học chuyên nghiệp, 1980, Nxb Đại học và Trung học chuyên nghiệp, Hà Nội.

BAA00022 - Physical Education II

GENERAL INFORMATION

Course ID:	BAA00022
Course name (English):	Physical Education II
Course name (Vietnamese):	Thể dục 2
Relation to curriculum:	General Education (compulsory)
Credit points:	2 credits (Theory: 1; Laboratory: 1) / ~ 3 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course equips students with fundamental knowledge of principles and methods of proper physical exercise and sports training, injury prevention in training, and the ability to perform basic techniques and tactics in badminton. The course content includes: Principles and methods of physical exercise and sports training; Common injuries in physical exercise and sports; Initial first aid and preventive measures; A brief overview of the history and impact of badminton; Principles of badminton techniques; Badminton game rules.

REQUIRED AND RECOMMENDED READING

[1] Cầu lông, Bành Mỹ Lệ, Hậu Chí Khánh, 1997, Nxb TDTT, Hà Nội.

BAA00101 - Marxist-Leninist Philosophy

GENERAL INFORMATION

Course ID:	BAA00101
Course name (English):	Marxist-Leninist Philosophy
Course name (Vietnamese):	Triết học Mác - Lênin
Relation to curriculum:	General Education (compulsory)
Credit points:	3 credits (Theory: 3; Laboratory: 0) / ~ 3 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course equips students with fundamental knowledge of the worldview and philosophical methodology of Marx and Lenin. It enables students to creatively apply the knowledge of the worldview and philosophical methodology of Marx and Lenin in their cognitive and practical activities to address the issues posed by the social life of the country and the era.

REQUIRED AND RECOMMENDED READING

- [1] Giáo trình Triết học Mác – Lênin, Bộ Giáo dục và Đào tạo, 2019, Nxb. Chính trị quốc gia, Hà Nội.
- [2] Bộ Giáo dục và Đào tạo (2012), Giáo trình Những Nguyên lý cơ bản của chủ nghĩa Mác – Lênin, Nxb. Chính trị quốc gia, Hà Nội.
- [3] Giáo trình Triết học Mác-Lênin, Hội đồng Trung ương, 2008, Nxb. Chính trị quốc gia, Hà Nội.

BAA00102 - Marxist-Leninist Political Economics

GENERAL INFORMATION

Course ID:	BAA00102
Course name (English):	Marxist-Leninist Political Economics
Course name (Vietnamese):	Kinh tế chính trị Mác - Lênin
Relation to curriculum:	General Education (compulsory)
Credit points:	2 credits (Theory: 2; Laboratory: 0) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course consists of 6 chapters. Chapter 1 focuses on the research subjects, research methods, and functions of Marxist-Leninist Political Economy. Chapter 2 to chapter 6 present the core content of Marxist-Leninist Political Economy according to the objectives of the course. Specifically, the topics covered include: Commodities, markets, and the roles of agents in a market economy; Surplus value production in a market economy; Competition and monopoly in a market economy; Market-oriented socialist economy and economic interests in Vietnam; Industrialization, modernization, and economic integration in Vietnam.

REQUIRED AND RECOMMENDED READING

- [1] Giáo trình kinh tế chính trị Mác – Lê nin dành cho bậc đại học không chuyên kinh tế chính trị.
- [2] Lịch sử các học thuyết kinh tế, Bản tiếng Việt, Robert, JR và Robert F. Hebert, 2003, Nxb Thống kê.
- [3] Giáo trình Kinh tế chính trị Mác – Lê nin, Viện Kinh tế chính trị học, Học viện Chính trị quốc gia Hồ Chí Minh, 2018, NXB Lý luận Chính trị.

BAA00103 - Scientific Socialism

GENERAL INFORMATION

Course ID:	BAA00103
Course name (English):	Scientific Socialism
Course name (Vietnamese):	Chủ nghĩa xã hội khoa học
Relation to curriculum:	General Education (compulsory)
Credit points:	2 credits (Theory: 2; Laboratory: 0) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course explores the principles, theories, and applications of the concept of Scientific Socialism. The course provides students with a comprehensive understanding of the historical development, philosophical foundations, and socio-political implications of Scientific Socialism. Throughout the course, students will delve into the key works and ideas of influential thinkers who have contributed to the development of Scientific Socialism. Students will examine the core principles of dialectical materialism, historical materialism, and the class struggle, gaining insights into the analysis of social structures, economic systems, and the dynamics of power relations. Upon completion of this course, students will have gained a solid foundation in the theory and practice of Scientific Socialism, enabling them to engage in informed discussions on socialist thought, societal transformation, and the pursuit of social justice.

REQUIRED AND RECOMMENDED READING

- [1] Giáo trình Chủ nghĩa xã hội khoa học, Bộ Giáo dục và Đào tạo, 2019, Nxb. Chính trị quốc gia, Hà Nội.
- [2] Giáo trình Những Nguyên lý cơ bản của chủ nghĩa Mác – Lênin, Bộ Giáo dục và Đào tạo, 2012, Nxb. Chính trị quốc gia, Hà Nội.
- [3] Giáo trình Chủ nghĩa xã hội khoa học, Hội đồng Trung ương, 2008, Nxb. Chính trị quốc gia, Hà Nội.

BAA00104 - History of Vietnamese Communist Party

GENERAL INFORMATION

Course ID:	BAA00104
Course name (English):	History of Vietnamese Communist Party
Course name (Vietnamese):	Lịch sử Đảng Cộng sản Việt Nam
Relation to curriculum:	General Education (compulsory)
Credit points:	2 credits (Theory: 2; Laboratory: 0) / ~ 2 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course offers a comprehensive exploration of the origins, development, and impact of the Vietnamese Communist Party on the history and society of Vietnam. This course provides students with a deep understanding of the ideologies, strategies, and leadership of the Vietnamese Communist Party throughout its history. Throughout the course, students will examine the key historical events and figures that contributed to the formation and evolution of the Vietnamese Communist Party. They will explore the Party's role in the struggle for national independence, its participation in the Vietnamese revolution, and its subsequent establishment of a socialist state. By the end of this course, students will have developed an understanding of the historical role and significance of the Vietnamese Communist Party, its contributions to Vietnam's development, and its position in the global communist movement.

REQUIRED AND RECOMMENDED READING

- [1] Chương trình môn học Lịch sử Đảng Cộng sản Việt Nam, Bộ Giáo dục và Đào tạo, 2019.
- [2] Giáo trình quốc gia các môn khoa học Mác – Lênin, Tư tưởng Hồ Chí Minh (2018), Giáo trình Lịch sử Đảng Cộng sản Việt Nam (tái bản có sửa chữa, bổ sung), Hội đồng Trung ương, 2018, Nxb. Chính trị quốc gia, Hà Nội.

CSC00006 - Introduction to Artificial Intelligence

GENERAL INFORMATION

Course ID:	CSC00006
Course name (English):	Introduction to Artificial Intelligence
Course name (Vietnamese):	Giới thiệu ngành Trí tuệ nhân tạo
Relation to curriculum:	General Education (compulsory)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course gives students an overview of the Artificial Intelligence field. Specifically, it mentions the history of the development and formation of Artificial Intelligence (AI) and the industry's current status and trends. General concepts and knowledge, including basic understanding of counting systems, computational systems, intelligent agents, learning methods, and game theory, are introduced visually to students. Approaches to solving AI problems based on different strategies are conveyed. The course also introduces job opportunities in companies related to the AI industry. Ethical topics are considered from many angles to help students understand what should and should not be done in implementing AI applications.

COURSE GOALS

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

1. Investigate and present topics related to AI industry-oriented fundamental knowledge both individually and in groups, demonstrating critical and creative thinking throughout the process.
2. Describe the data storage platform in the computer, including bits, bytes, images, sounds, and other related components. Also, explain the roles and characteristics of operating systems and computer networks in the AI field.
3. Recognize the main characteristics of AI, its related fields, and specialties, along with describing some emerging technologies and industry trends.
4. Summarize the concept of intelligent agents and explain their roles and meanings in building AI applications.
5. Describe the main problems that AI is currently solving and will be meaningful in future social contexts.
6. Describe the methods used by agents to solve problems, especially machine learning methods. Present the general characteristics of each method and the context of their application.
7. Describe the essential characteristics of AI ethics and apply them to deploying solutions related to AI.

REQUIRED AND RECOMMENDED READING

[1] Artificial Intelligence Basics: A Non-Technical Introduction, Tom Taulli, 2019, Apress.

CSC18001 - Introduction to Deep Learning

GENERAL INFORMATION

Course ID:	CSC18001
Course name (English):	Introduction to Deep Learning
Course name (Vietnamese):	Nhập môn học sâu
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course is designed to provide students advanced knowledge in machine learning techniques (classifying, clustering and feature representation) using deep learning and transfer learning models. Students practice with real projects such as sentiment analysis, face recognition, image generation. This course provides fundamental skills and open problems students who are going to do further research in artificial intelligence, natural language processing and computer vision.

The course is designed to provide students basic knowledge in deep learning (classifying, clustering and feature representation). Students are able to implement and train neural networks (from basic to complex). Some projects of text classification, face recognition provide students strong background knowledge for further research in artificial intelligence, natural language processing, computer vision, and speech processing.

COURSE GOALS

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

1. Operate basic deep learning architectures.
2. Construct an appropriate model when given a problem.
3. Generate new ideas for problems in this course.

REQUIRED AND RECOMMENDED READING

- [1] Deep Learning, Ian Goodfellow, Yoshua Bengio and Aaron Courville, 2016, MIT Press.
- [2] Deep Learning with Python, Second Edition, Francois Chollet, 2021, Manning.

CSC18101 - Artificial Intelligence for Information Security

GENERAL INFORMATION

Course ID:	CSC18101
Course name (English):	Artificial Intelligence for Information Security
Course name (Vietnamese):	Trí tuệ nhân tạo cho an ninh thông tin
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Fundamentals of Artificial Intelligence, Computer Networking

COURSE DESCRIPTION

The course is designed to answer 2 principal questions posed for information security: (1) What is artificial intelligence and what does it mean in information security? And (2) How do information security policies and solutions benefit from integrating artificial intelligence and information security?.

COURSE GOALS

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

1. Know the risks of information security.
2. Understand the potential and limitations of AI applied in information security.
3. Understand information security risks and prevention.
4. Understand and apply artificial intelligence solutions for information security.

REQUIRED AND RECOMMENDED READING

[1] Practical AI for Cybersecurity, Ravi Das, 2021, CRC Press.

CSC18102 - Mathematics for Optimization

GENERAL INFORMATION

Course ID:	CSC18102
Course name (English):	Mathematics for Optimization
Course name (Vietnamese):	Phương pháp toán cho tối ưu
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

The course is designed to provide students 3 main methods (1) Calculation method for optimization of 1-variable function, (2) Calculation method for optimization of multi-variable function (3) Heuristic methods for optimization problem.

COURSE GOALS

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

1. Describe the concepts of optimization problems.
2. Employ mathematical methods to solve optimization problems.
3. Apply optimization mathematical methods to solve the problems posed.

REQUIRED AND RECOMMENDED READING

[1] Mathematical Modelling, Mark M. Meerschaert, 2013, Academic Press.

CSC18103 - Swarm Intelligence

GENERAL INFORMATION

Course ID:	CSC18103
Course name (English):	Swarm Intelligence
Course name (Vietnamese):	Trí tuệ bầy đàn
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Fundamentals of Artificial Intelligence

COURSE DESCRIPTION

In swarm intelligence, groups of identical individuals are dealt with simple rules. Animal swarm can achieve a complicated behaviour by interaction between its members. This property can be applied in technical systems as well as complex optimization problems. An advanced application of swarm intelligence is in the field of swarm robotics, where simple and small robots can learn as the same time for completing predefined complex tasks. In this course, algorithms about swarm intelligence are presented, analyzed and compared.

COURSE GOALS

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

1. Show ability to work individually as well as collaboratively to present a technical or scientific report.
2. Describe swarm intelligence terms.
3. Express SI concepts and algorithms.
4. Determine and classify SI problems.
5. Apply SI in practical problems.
6. Operate SI applications for Swarm Robotics.

REQUIRED AND RECOMMENDED READING

- [1] Nature-Inspired Optimization Algorithms, Xin-She Yang, 2014, Elsevier.
- [2] Swarm intelligence, James Kennedy and Russell C. Eberhart, with Yuhui Shi, 2009, Academic Press.
- [3] Swarm Intelligence and Evolutionary Computation Theory, Advances and Applications in Machine Learning and Deep Learning, Georgios N. Kouziokas, 2023, CRC Press.

CSC18104 - Introduction to MultiAgent Systems

GENERAL INFORMATION

Course ID:	CSC18104
Course name (English):	Introduction to MultiAgent Systems
Course name (Vietnamese):	Nhập môn hệ thống đa tác nhân
Relation to curriculum:	Specializations (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Fundamentals of Artificial Intelligence

COURSE DESCRIPTION

MultiAgent Systems (MAS) are a new and promising area in the field of artificial intelligent. These systems are compound of multiple decision-making agents which interact in a shared environment to achieve common or conflicting goals. MAS research spans a range of technical problems, such as how to design MAS to incentivize certain behaviors in agents, how to design algorithms enabling one or more agents to achieve specified goals in a MAS, how information is communicated and propagated among agents, and how norms, conventions and roles may emerge in MAS. A vast array of applications can be addressed using MAS methodologies, including autonomous driving, multi-robot factories, automated trading, commercial games, automated tutoring, etc.

COURSE GOALS

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

1. Show ability to work individually or in a team to present a sample of scientific reports and subject-related content.
2. Examine English terms in the field of multiagent system.
3. Describe the concept of agents and multiagent systems, along with their main applications.
4. Discuss the key principles used to design intelligent autonomous agents, along with the main approaches and techniques taken to develop such agents.
5. Explain the key principles surrounding the design of multiagent systems, along with the main approaches and techniques taken to encourage interactions - cooperative in such systems.
6. Summarize the main issues related to the design of multiagent and specialized societies, along with the techniques used to make autonomous decisions in the context of multiagent.

REQUIRED AND RECOMMENDED READING

[1] Multiagent Systems: Introduction and Coordination Control, Magdi S. Mahmoud, 2021, CRC Press.

[2] Multiagent Systems, second edition (Intelligent Robotics and Autonomous Agents series), Gerhard Weiss, 2016, The MIT Press.

CSC18105 - Artificial Intelligence Applications

GENERAL INFORMATION

Course ID:	CSC18105
Course name (English):	Artificial Intelligence Applications
Course name (Vietnamese):	Trí tuệ nhân tạo ứng dụng
Relation to curriculum:	Graduating works (elective)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	Fundamentals of Artificial Intelligence

COURSE DESCRIPTION

The course aims to provide students with an awareness of the importance of Artificial Intelligence (AI) through observation and research into important AI applications in real life. Students are introduced to state-of-the-art AI research works as well as modern practical applications. Students will apply their knowledge of AI and machine learning to specialized areas of AI-centric systems such as building smart city, operating robots in production and customer service, meaningful information query system, etc. The course also helps students to have practical experience in the process of building some AI applications at a simple systematic and methodical level.

COURSE GOALS

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

1. Explain basic concepts, terminologies, responsibilities, work ethics, etc. in the field of Artificial Intelligence.
2. Describe the components of an AI application system and the principles of implementing these components.
3. Construct simple AI applications using supporting frameworks and tools.
4. Show personal aptitudes of logical thinking and communication.
5. Investigate designated online courses about some topics of AI applications and complete most learning items in that course.

REQUIRED AND RECOMMENDED READING

- [1] Giáo trình Cơ sở Trí tuệ nhân tạo, Lê Hoài Bắc and Tô Hoài Việt, 2014, NXB Khoa học và Kỹ thuật.
- [2] Artificial Intelligence: A Modern Approach, Stuart Russell, Peter Norvig, 2020, Pearson.
- [3] Deep Learning (Adaptive Computation and Machine Learning series), Ian Goodfellow, Yoshua Bengio, Aaron Courville, 2016, MIT Press.
- [4] Machine Learning, Tom Mitchell, 1997, McGraw-Hill.

CSC10010 - Introduction to Programming for Artificial Intelligence

GENERAL INFORMATION

Course ID:	CSC10010
Course name (English):	Introduction to Programming for Artificial Intelligence
Course name (Vietnamese):	Lập trình cho trí tuệ nhân tạo
Relation to curriculum:	Foundation in concentrations (compulsory)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course aims to acquaint students with the process of problem-solving using the Python programming language. It offers a comprehensive introduction to the software development process, emphasizing the aspects of programming, code writing conventions, and product testing. The course provides students with fundamental concepts in Python programming language such as data types and basic data structures (e.g., arrays, strings, sets, lists). Moreover, it facilitates students in gaining initial familiarity with the OpenCV library, file manipulation, and addressing a selection of elementary problems pertaining to Artificial Intelligence.

COURSE GOALS

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

1. Solve problems independently or collaborate with other members in a team.
2. List and explain English terminology related to the topic.
3. Use basic data types, conditional statements, loops, functions/procedures to solve simple problems.
4. Apply and synthesize general knowledge of data types, statements, programming skills, and relevant libraries to solve basic problems related to Artificial Intelligence.

REQUIRED AND RECOMMENDED READING

[1] Fundamentals of Python: First Programs, Kenneth A. Lambert, 2019, Cengage Learning.

CSC10011 - Software Engineering for Artificial Intelligence

GENERAL INFORMATION

Course ID:	CSC10011
Course name (English):	Software Engineering for Artificial Intelligence
Course name (Vietnamese):	Công nghệ phần mềm cho hệ thống trí tuệ nhân tạo
Relation to curriculum:	Foundation in concentrations (compulsory)
Credit points:	4 credits (Theory: 3; Laboratory: 1) / ~ 5 ECTS credits
Prior course(s):	

COURSE DESCRIPTION

This course provides students with knowledge, skills, and experience in building intelligent software systems based on artificial intelligence (AI). Students will grasp the fundamental principles, practice, methods, and tools in building systems professionally. They will be exposed to various stages in the software system development life cycle using AI models and solutions, ranging from requirement specification, data collection, analysis, design, implementation, evaluation, to system operation. Students will also develop teamwork skills in building these intelligence systems.

REQUIRED AND RECOMMENDED READING

[1] Building Intelligent Systems: A Guide to Machine Learning Engineering, Geoff Hulten, 2018, Apress.