Vietnamese-German University

Faculty of Engineering

MODULE HANDBOOK

Bachelor's Program in Computer Science

In accordance with the specific examination regulation of the bachelor's program in Computer Science

Editors

No.	Name	Role	Position	Contact
1	Assoc. Prof. Dr. Tuan-Duc NGUYEN	Chief Editor	Academic Coordinator of Computer Science	duc.nt@vgu.edu.vn

Update log

Version	Information correct as of
1	26 May 2021
2	10 June 2021

List of abbreviations

C	Compulsory module
CSE	Computer Science Engineering
E	Elective module
LO	Intended Learning Outcome
TBA	To be announced

Table of Contents

1. Objectives of the program

Computer scientists, who have completed their university studies at the VGU, have a deep understanding of underlying computer science principles, information technologies and software engineering practices with an active and project-based learning experience. Students are acquainted with a wide range of applications, ranging from the manufacturing and service industries to further scientific activities and also relating in contents to activities which are concerned with the design, development and deployment of software- technical systems in the most comprehensive sense.

The program prepares students to be competitive on job market and also to pursue their higher education in Master and PhD levels in Computer Science and Information Technology fields.

2. Program-level intended learning outcomes

No.	Intended learning outcomes
LO1	Apply knowledge of computing and mathematics appropriate to the discipline
LO2	Analyze a problem, and identify and define the computing requirements appropriate to its solution
LO3	Design, implement and evaluate a computer-based system, process, component, or program to meet desired needs;
LO4	Use current techniques, skills, and tools necessary for computing practices;
LO5	Function effectively on teams to accomplish a common goal;
LO6	Understand professional, ethical, legal, security, and social issues and responsibilities;
LO7	Communicate effectively in a variety of professional contexts.

3. Program structure and curriculum

ECTS Credit Points	Credit Points	Semester					
		1	2	3	4	5	6
Mathematical and Science	20	10	5	5	0	0	0
Computer Science Fundamental	55	15	20	25	0	0	0
Computer Science Advance	65	0	5	0	30	25	0
Multi-disciplinary	10	5	0	0	0	5	0
Internship	15	0	0	0	0	0	15
Thesis	15	0	0	0	0	0	15
Total ECTS Credit Points	**180**	**30**	**30**	**30**	**30**	**30**	**30**

Legend		Type	Semester	Credit Points	Academic Hours	Learning Activity	Weight for GPA
Type	C = Compulsory; CE = Compulsory Elective						
Credit Points	ECTS Credit Points						
Academic Hours	Academic hours per semester						
Learning Activity	- L = Lecture - La = Laboratory course - Pw = Project work - In = Internship - E = Exercise						
Mathematical and Science				**20**	**240**		
61CSE101	Algebra	C	1	5	60	L+E (60)	1
61CSE102	Calculus	C	1	5	60	L+E (60)	1
61CSE107	Discrete Mathematics	C	2	5	60	L+E (60)	1
61CSE214	Statistics	C	3	5	60	L(45), E (15)	1
Computer Science Fundamental				**55**	**660**		
61CSE103	Programming - 1	C	1	5	60	L+E (60)	1
61CSE104	Introduction to Computer Science	C	1	5	60	L+E (60)	1
61CSE105	Computer Architectures	C	1	5	60	L+E (60)	1
61CSE108	Algorithms and Data Structures	C	2	5	60	L+E (60)	1
61CSE109	Programming - 2	C	2	5	60	L+E (60)	1
61CSE110	Theoretical Computer Science, Automata and Formal Languages	C	2	5	60	L+E (60)	1
61CSE112	Introduction to Data Science and AI	C	2	5	60	L+E (60)	1
61CSE213	Software Engineering 1	C	3	5	60	L+E (60)	1
61CSE216	Databases	C	3	5	60	L+E (60)	1
61CSE217	Computer Network -1	C	3	5	60	L+E (50), Pw(10)	1
61CSE218	Operating Systems	C	3	5	60	L+E (60)	1
Computer Science Advance				**65**	**1020**		
61CSE111	IoT and Smart Devices	C	2	5	60	L(45), Lab (15)	1
61CSE215	Object-oriented Programming with Java	C	3	5	60	L+E (60)	1
61CSE219	Software Engineering 2	C	4	5	60	L+E (60)	1
61CSE220	Distributed Systems	C	4	5	60	L+E (60)	1
61CSE221	Realtime Systems	C	4	5	60	L+E (60)	1
61CSE222	IT Security	C	4	5	60	L+E (60)	1

Legend		Type	Semester	Credit Points	Academic Hours	Learning Activity	Weight for GPA
Type	C = Compulsory; CE = Compulsory Elective						
Credit Points	ECTS Credit Points						
Academic Hours	Academic hours per semester						
Learning Activity	- L = Lecture - La = Laboratory course - Pw = Project work - In = Internship - E = Exercise						
61CSE223	Computer Network - 2	C	4	5	60	L (30, La(30)	1
61CSE224	Programming Exercises	C	4	5	60	L+E (60)	1
61CSE325	Current Topics in Computer Science	C	5	5	60	L(30), Pw(30)	1
61CSE326	Project	C	5	10	120	L(30), E (30), Pw(60)	2
61CSE327	Compulsory elective 1	CE	5	5	60	L+E (45), Pw(15)	1
61CSE328	Compulsory elective 2	CE	5	5	60	L+E (45), Pw(15)	1
Multi-disciplinary				**10**	**120**		
61CSE106	Law and Data Protection	C	1	5	60	L+E (60)	1
61CSE329	General Study	C	5	5	60	L+E (60)	1
Internship				**15**	**N/A**		
61CSE330	Internship	C	6	15	N/A	N/A	3
Thesis		**C**		**15**	**N/A**		
61CSE399	Thesis	C	6	15	N/A	N/A	3
Total				**180**	**N/A**		

4. Curriculum mapping

Program Learning Outcomes	LO1	LO2	LO3	LO4	LO5	LO6	LO7
61CSE101	✓✓	✓					
61CSE102	✓✓✓	✓✓	✓				
61CSE103	✓	✓✓	✓	✓✓			
61CSE104	✓✓✓		✓✓			✓	
61CSE105	✓✓		✓	✓			
61CSE106						✓✓✓	✓✓
61CSE107	✓✓✓	✓	✓				
61CSE108	✓✓	✓	✓✓				✓
61CSE109	✓	✓✓	✓	✓✓✓			✓
61CSE110	✓✓						
61CSE111	✓		✓	✓✓	✓✓		✓
61CSE112	✓	✓	✓✓	✓✓			
61CSE213	✓	✓✓			✓		✓
61CSE214	✓	✓✓					
61CSE215		✓	✓✓✓	✓✓	✓✓		✓✓
61CSE216	✓✓		✓	✓✓	✓		✓
61CSE217	✓	✓	✓	✓✓	✓✓		✓✓
61CSE218	✓	✓		✓	✓		✓
61CSE219	✓	✓	✓✓		✓✓	✓	✓✓
61CSE220	✓	✓	✓	✓✓	✓✓		✓✓
61CSE221		✓	✓✓	✓✓	✓✓		✓✓
61CSE222	✓	✓	✓✓				
61CSE223	✓	✓	✓✓	✓✓	✓✓✓		✓✓
61CSE224			✓✓	✓	✓✓✓	✓	✓✓✓
61CSE325	✓	✓✓			✓✓✓	✓	✓✓
61CSE326		✓	✓✓	✓✓	✓✓✓	✓	✓✓✓
61CSE327	✓	✓✓			✓✓	✓✓	✓✓
61CSE328	✓	✓	✓✓		✓✓	✓	✓
61CSE329					✓✓	✓✓	✓✓
61CSE330	✓	✓	✓	✓✓	✓✓	✓	✓✓✓
61CSE399	✓✓✓	✓✓✓	✓✓✓	✓✓✓		✓✓	

Scale that shows the level of learning the student achieves a mastery or competency scale by the end of the program: ✓ Beginning - ✓✓ Intermediate - ✓✓✓Advanced

5. Module Descriptions

61CSE101 Algebra

MODULE DESCRIPTION

Module title **Algebra**
Module code **61CSE101**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Dr. Tran Thi Thu Huong	huong.ttt@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers	-	-	TBA
Tutorial	-	-		

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 1

Student workload

Credits	5	ECTS
Contact hours (Lecture+Exercise)	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

Basic calculus and experience with matrices

Applicability for other modules

Discrete Mathematics, Computer Networks, Introduction to AI and Data Sciences, Data Structure and Algorithms, Data bases.

Intended learning outcomes

- The students acquire knowledge of the structural and logic basics of electronic information processing.
- They are to be acquainted with abstract mathematical terms.
- The students have the ability to independently develop abstract concepts and to acquire basic techniques or processes
- They are acquainted with the essential concepts, structures and methods of basic algebra and linear algebra. In particular, they are well-acquainted with basic algebraic structures necessary for the comprehension of formal structures in Computer Science and they are proficient in handling them.
- The following extracurricular skills are acquired: analytical thinking, development of methodological expertise, handling abstract methods, structures and models.

Contents

In the following there is a list of possible topics for the contents focuses. The focuses can be treated at different depths

No.	Topic
1.	**The Fundamentals of Mathematics** – Set Theory – Propositional and predicate logic, methods of proof – Quantities – Relations: Binary relations, partial order relations, equivalence relations, m-ary relations – Induction and recursion
2.	**Number theory** – Number systems – Primes and dividers – Modulo calculations – Applications in cryptography
3.	**Groups, Rings, Fields** – Basic definitions – Multiplicative group – Applications in cryptography
4.	**Linear Algebra** – Systems of linear equations – Matrices – Vector spaces – Linear transformations

Learning activities

Activities	Explanation
Attendance	Students are recommended to attend at least 70% of contact hours.
Exercises/Home work	Tasks and examples of the lecture topics. The exercises serve to ensure that the students learn to understand the algebraic topics of tasks and solve them with the methods discussed. The students are continuously provided with qualified individual feedback which supports their specific learning experience. Through homework students can investigate applications of lectures in various fields of computer science.
Practice Tests	Students are recommended to take 1-2 practice tests after finishing each key part of the course.
Textbook reading	Students are encouraged to read textbooks to get more applications of the subject in the Computer Science field. Some specific applications in Computer Science can be assigned.

Modes of assessment

Practice Tests: Practice tests will be organized whenever finishing key parts of the course.

Length of Practice tests: Differentiated

Exams
- Length of examination: 90 minutes

Grading policy

Assessment method	Percentage of total	Assessment date
Assignments	20	
Final exam	80	
Total	**100**	

Module materials

Required texts

Linear Algebra:

[1] D. Lay, Linear Algebra and Its Applications, Pearson New International Edition, Pearson, 2014 (primary).

[2] Gilbert Strang, Linear Algebra and Its Applications, Fourth edition, Brooks/Cole Cengage Learning, 2006.

General Algebra

[3] Kenneth Rosen, Discrete Mathematics and its applications, Mc Graw Hill education, 2013.

Recommended texts

[4] Serge Lang, Introduction to Linear Algebra, Second edition, Springer (Linear algebra).

[5] Eric Lehman, F.T. Leighton, and A. R. Meyer, Mathematics for Computer Science, 2017 (General algebra).

[6] Joseph A. Gallian, Contemporary Abstract Algebra, Cengage learning, 2017 (Groups).

Written/updated by
Dr. Tran Thi Thu Huong
Date 20/05/2021

MODULE DESCRIPTION

Module title **Calculus**
Module code **61CSE102**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Dr. Tran Thi Thu Huong	huong.ttt@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers	-	-	TBA
Tutorial	-	-		

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 1

Student workload

Credits	5	ECTS
Contact hours (Lecture+Exercise)	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites
Prerequisites for module participation: None
Prerequisites for module examination: None

Applicability for other modules Discrete Mathematics, Statistics, Introduction to AI and Data Science, Data Structure and Algorithms

Intended learning outcomes

- The students are acquainted with the most important concepts, processes and techniques in differential and integral calculus. Thereby, the understanding of specific methods of analysis is predominant.
- The students have the ability to implement simple application problems into mathematical formulations and to solve them. Thereby, they fully understand the requirements and limits of differential and integral calculus methods.
- The following extracurricular skills are acquired: analytical thinking, development of methodological expertise, handling abstract methods, structures and models, the abstract implementation of practical application problems into formal models is enhanced.

Contents

No.	Topic
1.	Real numbers: sequences, series, convergence
2.	Limits and Continuity: - Tangent problems - Basic concepts - Limit law - Continuous functions - Intermediate value theorem
3.	Differential calculus of one variable: - Slope of curves, instantaneous velocity, rate of changes - Differentiability - Derivative rules - Extreme value theorems, Mean value theorem - Curve sketching - Linear approximation - Taylor's series, Maclaurent's series - Newton iteration methods
4.	Integral calculus - Distance problems, area under the curve problem, volume problem - Definite integral - Integrability - Primitives (anti-derivatives), net-change theorem - Fundamental Theorem of calculus - Elementary integration techniques - Applications
5.	Approximation method for solving nonlinear equations

Learning activities

Activities	Explanation
Attendance	Students are recommended to attend at least 70% contact hours.
Exercises/Homework	Tasks and examples of the lecture topics. The exercises serve to ensure that the students learn to understand the algebraic topics of tasks and solve them with the methods discussed. The students are continuously provided with qualified individual feedback which supports their specific learning experience. Through homework students can investigate applications of lectures in various fields of computer science.
Practice Test	Students are recommended to take practice tests after accomplishing each key part of the course.
Textbook reading	Students are encouraged to read textbooks to get more applications of the subject in the Computer Science field. Some specific applications in Computer Science can be assigned.

Mode of assessment

Practice Tests: Practice tests will be organized whenever finishing key parts of the course.

Length of Practice tests: Differentiated

Exams
- Length of examination: 90 minutes

Grade policy:

Assessment method	Percentage of total	Assessment date
Assignments	20	
Final exam	80	
Total	**100**	

Module materials

Required texts
1. James Stewart, Essential Calculus, 2007 (Primary textbook).
2. George B. Thomas Jr., Maurice D. Weir, Joel R. Hass, Frank, R. Giordano, Thomass Calculus, 2007, 11th edition.

Recommended texts

Written/updated by
Dr. Tran Thi Thu Huong
Date 20/05/2021

MODULE DESCRIPTION

Module title **Programming 1**
Module code **61CSE103 Programming 1**
Study program **Computer Science (CSE)**

Module Coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Dr. Quang-Vinh DINH	vinh.dq2@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers			TBA
Tutorial				None
Lab				None
Other				None

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 1

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency

The module is offered each academic year.

Prerequisites

None

Intended learning outcomes

After successful completion of the programmes, the students have the following core competencies:

- A good command of the most important linguistic elements and archiving functions
- Ability to formulate solutions for simple tasks as a structured design, as well as their implementation in C
- A good command of methods for error detection and error elimination

The following extracurricular skills are acquired: concept formation, structured problem solving, creative problem solving and command of methods for error detection and elimination. Capacity for teamwork by means of cooperation in groups and the ability to accept criticism and conflicts respectively as well as reflecting capacity, communication, connection of theory and practice.

Contents

No.	Topic
1.	Introductory example with basic language elements
2.	Analysis of simple tasks and creating a structured solution proposal
3.	Editing, compiling, executing programs
4.	Elementary data types, variables, and arithmetic
5.	Input/output
6.	Branching and looping
7.	Fields, string
8.	Troubleshooting and fault elimination
9.	Pointers, dynamic memory management
10.	Subprograms (functions) and parameters, modular program structure, library functions
11.	Files
12.	Structured data types

Learning activities

Activities	Explanation
Attendance	Recommendation
Individual Assignments	3-4 assignments
Group work	Presentation
Online Activities	VGU's e-learning platform for student discussion and share on topics, group and individual works.
Self-study	Students are recommended for self-learning and research
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Exams

- Final written exam 120 minutes.
- Printed materials and references are allowed in the final exam room.

Grading policy

Assessment method	Percentage of total	Assessment date
Assignments	20	
Final exam	80	
Total	**100**	

Module materials

Required texts

Recommended texts

1. Erlenkötter, H., C Programmieren von Anfang an, Rowohlt, 2008
2. Mittelbach, H., Einführung in C, Fachbuchverlag Leipzig, 2002
3. Die Programmiersprache C. Ein Nachschlagewerk, Regionales Rechenzentrum für Niedersachsen/Universität Hannover, 1RRZN

Written/updated by
Dr. Dinh Quang Vinh
Date: 25 / 05 /2021

MODULE DESCRIPTION

Module title **Introduction to Computer Science**
Module code **61CSE104**
Study program **Computer Science (CSE)**

Module Coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Huynh Trung Hieu	hieu.ht@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers	-	-	TBA
Tutorial				

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 1

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Applicability for other modules

Applicable to other Computer Science Bachelor programmes

Intended learning outcomes

By the end of the course, the students should be able to:

- Demonstrate knowledge of the different areas of computing disciplines.
- Explain computer models
- Explain number processing at hardware level
- Recognize the structure and the mode of operation of processors, top trends in computer science.
- Demonstrate the computer processes during programming and programme run

Contents

No.	Topic
1.	Computing disciplines.
2.	Computer basics, presenting and processing information on the computer.
3.	Introduction to computer system.
4.	Computer networks and Internet.
5.	Introduction to algorithms and programming languages.
6.	Top trends in computer science.
7.	Social and Ethical Issues.

Learning activities

Activities	Explanation
Attendance	According to VGU regulation.
Individual Assignments	None
Group work	None
Online Activities	None
Self-study	60 hours
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Exams

- Final written exam 90 minutes.
- Printed materials and reference are allowed in the final exam room.

Grading policy

Assessment method	Percentage of total	Assessment date
Assigments	20	
Final exam	80	
Total	**100**	

Module materials

Required texts

Recommended texts

1. Behrouz A. Forouzan, Foundations of Computer Science, 4th edition, 2018.
2. Kevin P Hare, Pindar Van Arman, Computer Science Principles: The Foundational Concepts of Computer Science - For AP® Computer Science Principles.
3. Pradeep K. Sinha and Priti Sinha, Foundations of Computing, BPB Publication
4. Herold, Lurz, Wohlrab: Grundlagen der Informatik: praktisch, technisch, theoretisch, Pearson Studium, 2006
5. Association for Computing Machinery, www.acm.org
6. Current literature will be announced at the beginning of the semester.

Written/updated by

Assoc. Prof. Huynh Trung Hieu

Date: 19 / 5 /2021

MODULE DESCRIPTION

Module title **Computer Architecture**
Module code **61CSE105**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Huynh Trung Hieu	hieu.ht@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers	-	-	TBA
Tutorial				

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 1

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Applicability for other modules

Applicable to other modeles in Computer Science Bachelor programme

Intended learning outcomes

The objective of this course is that the students acquire theoretical and practical competencies in the following areas:

- Digital technology.
- Computer Architectures.
- Assembler Languages.

By the end of the course, the students should be able to:

- Develop simple circuits from logic formulate.
- Use logic gate level and block level to build components of a simple computer.
- Explain the most important architectural principles for designing a computer system.
- Explain how the various parts of a modern computer function and cooperate.
- Program in assembly language.

Contents

No.	Topic
1.	Introduction to computer abstraction.
2.	Number systems and codes, Boolean algebra, logic gates and circuits.
3.	Simplification, combinational circuits, sequential circuits, middle scale integration (MSI) components.
4.	Assembly language, instruction set design, instruction formats, addressing modes, instruction set architectures (ISA).
5.	Processor: datapath and control design.
6.	Processor pipelining, pipeline hazards
7.	Memory hierarchy: cache, virtual memory.
8.	Performance.

Learning activities

Activities	Explanation
Attendance	According to VGU regulation.
Individual Assignments	Tasks and examples on the topics of the unit lecture computer architecture. The exercises serve to ensure that the students learn to deal with the concepts learned in the lecture and to be able to apply these concepts in concrete examples. Exercises on the computer for programming in the Assembly language. The students shall learn to work on easy tasks with the help of Assembly programs.
Group work	None
Online Activities	None
Self-study	90 hours
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Exams
- Final written exam 120 minutes.
- Printed materials and reference are allowed in the final exam room.

Grading policy

Assessment method	Percentage of total	Assessment date
Assigments	20	
Final exam	80	
Total	**100**	

Module materials

Required texts

Recommended texts

1. D A Patterson & J L Hennessy, Computer Organization and Design: the hardware/software interface, Morgan-Kaufmann, 5th edition.
2. William Stallings, Computer Organization and Architecture, Prentice Hall of India, 10th edition

Written/updated by

Assoc. Prof. Huynh Trung Hieu

Date: 19 / 5 /2021

MODULE DESCRIPTION

Module title **Law and Data protection**
Module code **61CSE106**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Dr. Dinh Hai Dung	dung.dh@vgu.edu.vn	A109	TBA
Lecturers	VGU Lecturers			TBA

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 1

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Intended learning outcomes

On successful completion of this module:

1. The students are acquainted with the basic legal terminologies of civil law (contracts, terms and conditions, copyright law) and have obtained a broadened knowledge of data protection law in particular.
2. The students have the ability to solve legal case problems independently.
3. In addition to this, the following extracurricular skills are developed: structured problem solving, ability to make sound decisions, considering the projects in terms of legal aspects.

Contents

No.	Topic
1.	The following possible topics are listed for the contents focuses. The focuses can be treated at different depths. Basics Law - Contract design - Terms and conditions of the contract - Warranty and liability claims - Interfaces to the copyright Basics Data Privacy Protection - Terms of data privacy protection - Rights of the parties involved - Data privacy protection in the international sphere Interface IT Security
2.	Exercices: - Tasks and examples on the lecture topics. - The exercises serve to ensure that the students learn to understand the legal problems and to solve them independently.

Learning activities

Activities	Explanation
Attendance	Students should attend 100%.
Individual Assignments	Assignments are given to test students' learning and development.
Group work	Group of 4-5 students for a group assigment
Online Activities	VGU's e-learning platform for student discussion and share on topics, group and individual works.
Self-study	None
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Assignments: Homeworks and Quiz
Group work: Legal or Data privacy investigation project
Exams: One final examination: 90 minutes

Grading policy

Assessment method	Percentage of total	Assessment date
Assignments	40	One per 2 weeks
Final exam	60	
Total	**100**	

Module materials

Recommended materials

1. Lecturer hand out and documents.

Written/updated by
Dr. Dinh Hai Dung
Date / /2021

MODULE DESCRIPTION

Module title **Discrete Mathematics**
Module code **61CSE107**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Dr. Tran Thi Thu Huong	huong.ttt@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturer	-	-	TBA
Exercise				TBA

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 2

Student workload

Credits	5	ECTS
Contact hours (Lecture+Exercise)	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency

The module is offered each academic year

Prerequisites

Applicability for other modules

Computer Networks, Statistics, Introduction to AI and Data Sciences, Data Structure and Algorithms, Theoretical Computer Science, Data bases, Software Engineering, Programming courses.

Intended learning outcomes

- Based on the modules Algebra and Analysis, the students deepen their ability to work with abstract concepts. This is a key qualification for Computer Science. Precisely, the students acquire the most important mathematical techniques for applications in the core disciplines of Computer Science (Theoretical Computer Science, Computer Architecture, Operating Systems, Computer Networks, etc.) within this module.
- The students have fundamental competencies and knowledge in the field of discrete mathematics. They have the ability to apply concepts and processes they have become acquainted with during the module.
- They have the ability to implement discrete mathematics solutions in simple cases of applications and to assess the results. The students have the ability to identify the relations between discrete mathematics and core disciplines of Computer Science and they have the

ability to adequately apply processes of discrete mathematics in those contexts.

- The competencies in dealing with formal systems and models are further developed in this module.
- Furthermore, the following extracurricular skills are acquired in the module: logical thinking, ability to think in abstract terms, scientific processes, attention to detail.

Contents

The following possible topics are listed for the contents focus. The focuses can be treated at different depths.

No.	Topic
1.	**Counting** – Popular combinatorial objects: binary strings, combinations, permutations, combinations with repetition, partitions, number partitions. – 4 basic counting principles: Addition, multiplication, division, bijection – Advanced counting rules: Generating functions, principle of inclusion and exclusion – Applications: Binomial/Multinomial coefficients, Pascal triangle, linear recurrence equations…
2.	**Introduction to Coding Theory** - Basic concepts - Linear codes
3.	**Graph Theory** - Basic concepts - Graph models: - Graph properties: Graph isomorphism, connected graphs, Eulerian and Hamiltonian graphs, planar graphs, graph colorings - Trees: Basic concepts, (Complete) binary trees, Decision trees, Tree traversals, Spanning trees, labeled trees, matrix-tree theorem. - Applications: Minimum spanning trees, Shortest paths, maximum flows, matching

Learning activities

Activities	Explanation
Attendance	Students are recommended to attend at least 70% of contact hours.
Exercises/Homework	Tasks and examples of the lecture topics. The exercises serve to ensure that the students learn to understand the algebraic topics of tasks and solve them with the methods discussed. The students are continuously provided with qualified individual feedback which supports their specific learning experience. Through homework students can investigate applications of lectures in various fields of computer science.
Practice Tests	Students are recommended to take 1-2 practice tests after finishing each key part of the course.
Textbook reading	Students are encouraged to read textbooks to get more applications of the subject in the Computer Science field. Some specific applications in Computer Science can be assigned.

Mode of assessment

Practice Tests: Practice tests will be organized whenever finishing key parts of the course.

Length of Practice tests: Differentiated

Exams
- Length of examination: 90 minutes

Grading policy:

Assessment method	Percentage of total	Assessment date
Assignments	20	
Final exam	80	
Total	**100**	

Module materials

Required texts

[1] K. Rosen, Discrete Mathematics and its applications, 6th edition (primary).
[2] Martin Aigner, Discrete Mathematics, second edition.

Recommended texts

[3] R. Stanley, Enumerative Combinatorics, Vol. 1.
[4] Reinhard Diestel, Graph theory, Springer, 2010.

Written/updated by
Dr. Tran Thi Thu Huong
Date 20/05/2021

MODULE DESCRIPTION

Module title **Algorithms and Data Structures**
Module code **61CSE108**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Dr. Tuan-Duc NGUYEN	duc.nt@vgu.edu.vn	A109	TBA
Lecturer	Assoc. Prof. Dr. Tuan-Duc NGUYEN, CS Lecturers	duc.nt@vgu.edu.vn	A109	TBA
Exercise				TBA

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 2

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Intended learning outcomes

On successful completion of this module the learner will be able to:

1. The students should have a conceptual understanding of algorithms, data structures, complexity etc. in order to have the ability for the following aspects of simple to medium level problems
2. Create suitable new data structures (based on the standard structures discussed in the course)
3. Develop and demonstrate algorithms based on the methods learned in the module
4. Assess possible solutions with respect to accuracy, complexity and elegance.
5. The students should have the ability to confidently and competently apply concepts and techniques acquired in this module in subsequent modules within Computer Science.
6. Extracurricular skills: structured problem solving, creative problem solving, teamwork and communication in group working.

Contents

No.	Topic
1.	Data Structures: - Elementary data structures - Standard linear structures (fields, lists, stacks, queues) - Trees - Quantities - Graphs
2.	Algorithms for the basic problems of Computer Science - Sort - Search - Hashing
3.	Algorithms: - Definition of an algorithm, semantic correctness - Description types of algorithms (natural language, pseudo code, structure chart, data flow diagram, programme flow chart) - Capacity considerations: space and computing time, asymptotic notations, capacity dimensions (worst case , average case), P-NP problem - Types of algorithmic approaches (recursion, greedy, divide and conquer, Backtracking...) - Basic concepts of the parallel algorithms: work law, span law, speed-up , parallelism necessity for synchronization procedure

Learning activities

Activities	Explanation
Attendance	Students should attend 100%.
Individual Assignments	Regular assignments are given to test students' learning and development.
Group work	None
Online Activities	VGU's e-learning platform for student discussion and share on topics, group and individual works.
Self-study	Students are recommended for seldf-study
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Assignments: 4-5 assignments (Homeworks and Quiz)

Exams: One final examination: 90 minutes

Grading policy

Assessment method	Percentage of total	Assessment date
Assignments	40	One per 2 weeks
Final exam	60	
Total	**100**	

Module materials

Required texts

1. Aho, A. V., Hopcroft, J. E., Ullman, J. D.: The Design and Analysis of Computer Algorithms, Addison-Wesley 1974
2. Brunskill, D., Turner, J.: Understanding Algorithms and Data Structures, McGraw-Hill 1996
3. Thomas H. Cormen, Charles E. Leiserson, and Ronald L. Rivest. Algorithmen - Eine Einführung. Oldenbourg Wissenschaftsverlag, 2. Auflage, 2007

Recommended materials

2. Lecturer hand-out and documents.

Written/updated by
Assoc. Prof. Dr. Nguyen Tuan Duc
Date / /2021

MODULE DESCRIPTION

Module title **Programming 2**
Module code **61CSE109**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Huynh Trung Hieu	hieu.ht@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers	-	-	TBA
Exercise				TBA

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 2

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

Successful participation in modules “Introduction to programming” or “Programming 1”

Applicability for other modules

Applicable to other Computer Science Bachelor programmes

Intended learning outcomes

By the end of the course, the students should be able to:

- Describe the important concepts in object-oriented programming (OOP).
- Write simple programs in C++ using the variables, operators, control structures, functions, and I/O streams.
- Write programs in C++ using objects and classes.
- Utilize the features of OOP such as abstract data type, inheritance, polymorphism to develop programs for given problems.
- Develop the applications using OOP with C++.
- Effectively function on teams to accomplish a common goal.

Contents

No.	Topic
1.	Overview of OOP and C++, operators, dynamic memory management.
2.	Objects and classes, constructors, destructors, copying and assigning objects.
3.	Inheritance, access rights, multiple inheritance, virtual inheritance, overriding.
4.	Polymorphism, operator overloading, templates.
5.	Container classes in C++
6.	Object-oriented analysis and design

Learning activities

Activities	Explanation
Attendance	According to VGU regulation.
Individual Assignments	Tasks and examples on the topics The exercises serve to ensure that the students learn to deal with the concepts learned in the lecture and to be able to apply these concepts in concrete examples.
Group work	Teamwork in groups on assignments or tiny projects.
Online Activities	None
Self-study	90 hours
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Exams

- Final practical exam 120 minutes.
- Printed materials and reference are allowed in the final exam room.

Grading policy

Assessment method	Percentage of total	Assessment date
Final exam	100	
Total	**100**	

Module materials

Required texts

Recommended texts

3. Stroustrup, Bjarne, The C++ Programming Language, Pearson.
4. Brahma Dathan, Sarnath Ramnath, Object-Oriented analysis, design, and implementation.
5. Robert C. Martin, Clean Code.

Written/updated by

Assoc. Prof. Huynh Trung Hieu

Date: 19 / 5 /2021

MODULE DESCRIPTION

Module title **Theoretical Computer Science**
Module code **61CSE110**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Dr. Tran Hong Ngoc	ngoc.tth@vgu.edu.vn	A109	TBA
Lecturer	Dr. Trần Thị Thu Hương	huong.ttt@vgu.edu.vn	A109	TBA
	Dr. Tran Hong Ngoc	ngoc.tth@vgu.edu.vn	A109	TBA

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 2

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Applicability for other modules

Computer Networks, Computer Architecture, Programming languages

Intended learning outcomes

On successful completion of this module the learner will be able to:

1. Acquire the theoretical basics for the operating principles of computers and for the concepts of programming languages.
2. Learn the basic concepts of automata and the formal languages.
3. Understand their relevance for the architectural principles of computers on the one hand and for higher level programming languages and other areas of Computer Science on the other hand.
4. Acquire the following extracurricular skills: concept formation, scientific work, structured problem solving, creative problem solving.

Contents

No.	Topic
1.	**Finite Automata (FA) and Regular Languages** - Deterministic FA and Non-deterministic FA - Regular Languages, Regular grammars and Regular Expressions - Properties of Regular Languages - Non-regular Languages and Pumping Lemma
2.	**Context-free Languages (CFLs) and Push down automata (PDA)** - Context-free Grammars (CFGs) - CFLs and its Properties - Simplifications of CFGs and Normal forms - CFGs and PDA - Applications
3.	**Selective topics**: Turing machines, recursivity, computability, complexity, P-NP problem, etc.

Learning activities

Activities	Explanation
Attendance	Students are expected to attend all classes. Attendance check is conducted at the beginning of the classes. There is no grade for attendance check.
Practice Tests	Practice tests are organized whenever key parts of the course are done.
Exercises/ Homework	During or after each lecture.

Mode of assessment

Practice Tests

- Practice tests are organized whenever key parts of the course are done.

Final Examination

- Length of examination: 90 minutes

Grading policy

Assessment method	Percentage of total	Assessment date
Practice Tests	20	
Final Examination	80	
Total	**100**	

Module materials

Recommended Reading:

1. Michael Sipser: Introduction to the Theory of Computation, Third edition, Cengage Learning, 2013
2. J.E. Hopcroft and J.D. Ullman, Introduction to Automata Theory, Languages and Computation, Third edition, Addison Wesley, 2001
3. Peter Linz: An Introduction to Formal Languages and Automata, Fifth edition, Jones & Bartelett learning, 2012
4. Robert McNaughton: Elementary Computability, Formal Languages, and Automata, Prentice-Hall, 1982
5. Christos H. Papadimitriou: Computational Complexity, Addison-Wesley, 1993

Written/updated by
Dr. Tran Hong Ngoc
Date 20/05/2021

61CSE111 IoT and Smart Device

MODULE DESCRIPTION

Module title **IoT and Smart Devices**
Module code **61CSE111**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Dr. Tuan-Duc NGUYEN	duc.nt@vgu.edu.vn	B	9:00-11:00 AM, Mon to Fri
Lecturer	Assoc. Prof. Dr. Tuan-Duc NGUYEN	duc.nt@vgu.edu.vn	B	9:00-11:00 AM, Mon to Fri
Tutorial				None
Lab				None
Other	None			

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 2

Student workload

Credits	5	ECTS
Lecture contact hours	45	AHs
Lab contact hours	15	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Intended learning outcomes

On successful completion of this module the learner will be able to:

1. Knowledge and understanding of basic concept and hardware of IoT and smart devices, smart device platform using oriented high-level programming environment.
2. The ability to model embedded systems and implement them into programmes
3. Knowledge and understanding of IoT and Smart devices programming using high performance microcontroller/application processor Kits.
4. Extracurricular skills are acquired: Lab experiences, working in groups in project, structured problem solving, communication and presentation skills.

Lecture Contents

No.	Topic
1.	Introduction to Embedded Systems
2.	Introduction to IoT Devices, IoT Network and IoT Application
3.	Embedded Programming with Adruino
4.	Smart Device Programming with Raspberry Pi
5.	Lab Project: - Develop an IoT/Smart Devices application on Adruino and Raspery Pi

Learning activities

Activities	Explanation
Attendance	Students should attend 100%.
Individual Assignments	3-4 assignments are given to test students' learning and development.
Group work	Group of 4-5 students for a group assigment and Seminar
Online Activities	VGU's e-learning platform for student discussion and share on topics, group and individual works.
Self-study	Students are recommended for seldf-study
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Assignments: 4-5 assignments (Homeworks and Quiz)

Group project: group of 4-5 students

Exams: One final examination: 90 minutes

Grading policy

Assessment method	Percentage of total	Assessment date
Assignments	20	
Project	40	
Final exam	40	
Total	**100**	

Module materials

Required texts

4. Embedded Systems Design with the Atmel AVR Microcontroller (Synthesis Lectures on Digital Circuits and Systems). (2009) Steven Barrett
5. Nauth, P. (2001): Embedded Intelligent Systems. Oldenbourg

Recommended materials

3. Lecturer hand out and documents.
4. Adruino Programming Handbook
5. Raspberry Pi Programming Handbook

Written/updated by
Assoc. Prof. Dr. Nguyen Tuan Duc
Date / /2021

MODULE DESCRIPTION

Module title **Introduction to Data Science and AI**
Module code **61CSE112**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Huynh Trung Hieu	hieu.ht@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers	-	-	TBA
Exercise				TBA

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 2

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Applicability for other modules

Applicable to other Computer Science Bachelor programmes

Intended learning outcomes

This course aims to provide students with an understanding of basic techniques for data analysis. The fundamental technology of Artificial Intelligence (AI) and computational tools that are fundamental for data science will also be introduced.

By the end of the course, the students should be able to:

- Identify fundamental issues in AI.
- Identify interesting data-driven questions.
- Collect and visualize data, and perform exploratory analysis on data.
- Perform machine learning models to extract meaningful insights from data.
- Implement above techniques with Python or R.

Furthermore, the following extracurricular skills are acquired: structured problem solving, creative problem solving.

Contents

No.	Topic
1.	Fundamental issues in AI and data science
2.	Data collection, data wrangling, clearning, and sampling.
3.	Data visualization and management
4.	Data analysis, regression, classification, and clustering.
5.	Communication, summarizing results.
6.	The state-of arts - Neural networks - Deep learning

Learning activities

Activities	Explanation
Attendance	According to VGU regulation.
Individual Assignments	Tasks and examples on the topics Coding to address practical applications of data science techniques
Group work	None
Online Activities	None
Self-study	90 hours
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Exams

- Final practical exam 120 minutes.
- Printed materials and reference are allowed in the final exam room.

Grading policy

Assessment method	Percentage of total	Assessment date
Assigments	20	
Final exam	80	
Total	**100**	

Module materials

Required texts

Recommended texts

1. Gareth James, Daniel Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning.
2. Stuart Russell and Peter Norvig (2016) Artificial Intelligence: A Modern Approach, 3rd edition. Pearson

Written/updated by

Assoc. Prof. Huynh Trung Hieu

Date: 19 / 5 /2021

MODULE DESCRIPTION

Module title **Software Engineering - 1**
Module code **61CSE213**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Manuel Clavel	manuel.clavel@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers			TBA
Exercise				TBA

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 3

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Applicability for other modules

The module “Software Engineering - Design” is the natural continuation of this module.

Intended learning outcomes

- Assessment and estimation of the applicability of software engineering methods in an application development context
- Knowledge and understanding of different models of the software process and of classical and object-oriented software requirements analysis
- Understanding the roles of software developers and project managers
- Basic proficiency in the software engineering of large software systems

Extracurricular skills (20% of total workload): project- and teamwork, methods of project management, presentation techniques, ability to judge, English as the language of software engineering, socio-cultural importance of Computer Science, systems analysis and design, working in international teams.

Contents

No.	Topic
1.	The software product. The changing nature of software. Software development myths.
2.	The software process. Process models. Agile Development
3.	Modeling. Requirements modeling. Developing use cases. Scenario-based methods. Class-based methods.
4.	Software quality management. Software quality assurance. Software testing strategies. Security engineering. Software configuration management.
5.	Managing software projects. Process and project metrics. Project scheduling. Risk management.

Learning activities

Activities	Explanation
Attendance	According to VGU regulation.
Individual Assignments	None
Group work	Teamwork in small groups
Online Activities	None
Self-study	90 hours
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Exams

- Final written exam 90 minutes.
- Prerequisites for module examination: successful completion of the group work.
- No materials, reference are allowed in the final exam room.

Grading policy

Assessment method	Percentage of total	Assessment date
Final exam	100	
Total	**100**	

Module materials

Required texts

Recommended texts

1. Software Engineering: A Practitioner's Approach. 9th Edition. Roger S. Pressman and Bruce Maxim. Mcgraw-Hill Higher Education. (2020)
2. Software Engineering. 10th Edition. Iam Sommerville. Pearson. (2015)

Written/updated by

Assoc. Prof. Manuel Clavel

Date: 19 / 5 /2021

MODULE DESCRIPTION

Module title **Statistics**
Module code **61CSE214**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Dr. Tuan-Duc NGUYEN	duc.nt@vgu.edu.vn	A109	TBA
Lecturer	Assoc. Prof. Dr. Tuan-Duc NGUYEN	duc.nt@vgu.edu.vn	A109	TBA
Tutorial				None
Lab				None
Other	None			

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 3

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Intended learning outcomes

On successful completion of this module the learner will be able to:

1. The students have learned basic ideas and methods of descriptive statistics, probability theory and inferential statistics, based on their knowledge from the modules Analysis and Discrete Mathematics.
2. The students can use basic methods of the descriptive statistics. They can handle the concept of probability theory and its mathematical implementation in the context of discrete and continuous stochastic models. They are acquainted with the basic ideas of inferential statistics and can apply some important estimation and test methods and interpret the results thereof.
3. The module extends and deepens the mathematical method competence and the ability to handle formal concepts and systems.
4. Extracurricular skills: scientific work, technical English

Contents

No.	Topic
1.	Typical issues of applied statistic Basic concepts of statistics
2.	Methods of descriptive statistics (measures, graphical methods)
3.	Probability (Random variable, independence, conditional probability, Bayes' rule, distributions)
4.	Dealing with selected distributions, such as the binomial distribution, the normal distribution, the exponential distribution, etc. and their random regions
5.	Basics of inferential statistics (population, sample, hypotheses, inference with incomplete information, α-, β-errors, statistical significance)
6.	Estimation of parameters and confidence intervals, selected statistical tests (comparison of means, one-way analysis of variance)

Learning activities

Activities	Explanation
Attendance	Students should attend 100%.
Individual Assignments	Regular assignments are given to test students' learning and development.
Group work	None
Online Activities	VGU's e-learning platform for student discussion and share on topics, group and individual works.
Self-study	Students are recommended for seldf-study
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Assignments: 4-5 assignments (Homeworks and Quiz)

Exams: One final examination: 90 minutes

Grading policy

Assessment method	Percentage of total	Assessment date
Assignments	30	One per 2 weeks
Final exam	70	
Total	**100**	

Module materials

Required texts

1. Montgomery, Runger: Applied Statistics and Probability for Engineers, Wiley.

Recommended materials

1. Online Statistics: http://onlinestatbook.com/
2. Virtual Laboratories in Probability and Statistics: http://www.math.uah.edu/stat
3. Website: *MathCentre*http//www.mathcentre.co.uk

Written/updated by
Assoc. Prof. Dr. Nguyen Tuan Duc
Date / /2021

MODULE DESCRIPTION

Module title **OO Programming in Java**
Module code **61CSE215**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Dr. Quang-Vinh DINH	vinh.dq2@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers			TBA
Exercise				TBA

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 3

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

Programming-2

Intended learning outcomes

After successful completion of the programmes, the students have the following core competencies:

- The students are able to design and implement demanding Java applications
- The students acquire broad and deepened expertise concerning object-oriented programming
- The students improve their ability to work in teams and thus acquire extracurricular skills

The following extracurricular skills are acquired: concept formation, structured problem solving, creative problem solving and command of methods for error detection and elimination. Capacity for teamwork by means of cooperation in groups and the ability to accept criticism and conflicts respectively as well as reflecting capacity, communication, connection of theory and practice.

Contents

No.	Topic
1.	Constructs of the object-oriented programming, in particular the programming language Java
2.	Platform-independent specification
3.	Design and implementation of applications with a dialog interface using at least one pre-assembled class library (Swing or JavaFX)
4.	Design and implementation of applications with Java web technology (JSP/Servlet)

Learning activities

Activities	Explanation
Attendance	Recommendation
Individual Assignments	3-4 assignments
Group work	Project work (6 weeks)
Online Activities	VGU's e-learning platform for student discussion and share on topics, group and individual works.
Self-study	Students are recommended for self-learning and research
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Exams

- Project work (6 weeks). The students have to develop a Java application including complete documentation. The program has to be correct with respect to its specification.

Grading policy

Assessment method	Percentage of total	Assessment date
Assignments	20	
Project	80	
Total	**100**	

Module materials

Required texts

Recommended texts

1. Horstman, Cay S.; Cornell, Gary: Core Java. Upper Saddle River, N.J.: Prentice-Hall, 2 Bde., Bd. 1: 2007, Bd. 2: 2008
2. Jendrock, Eric; Evans, Ian; Gollapudi, Devika; Haase, Kim; Srvivathsa, Chinmayee: The Java EE 6 Tutorial. Version: July 2011
3. Cay S. Horstmann: Core Java Volume I – Fundamentals. Prentice Hall, 2018.

Written/updated by

Dr. Dinh Quang Vinh

Date: 25 / 05 /2021

MODULE DESCRIPTION

Module title **Databases**
Module code **61CSE216**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Manuel Clavel	manuel.clavel@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers			TBA
Exercise				TBA

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 3

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Intended learning outcomes

Databases are incredibly prevalent and play a key role in just about any IT system that maintains some amount of persistent information. This module conveys core competencies in the discipline of computer science, which will qualify students to design and use databases as a central component for information processing.

The focus is on relational databases:

- The students will gain a solid knowledge of the relational data model and the practical usage.
- They will learn through practical exercises using a specific database management system to master the standard database language SQL.

Furthermore, the following extracurricular skills will be acquired: project- and teamwork, structured problem solving, creative problem solving, English language.

Contents

No.	Topic
1.	Conceptual Basics. Database concept. Database architecture. Data Models.
2.	The Relational Model. Data model, structural integrity constraints, relations-algebra, database schema. The relational data definition and manipulation language SQL.
3.	Database Design and Relational Database Schema. Entity-relationship model. Normalization process.
4.	System Architecture. System catalogues, user management, transaction management.
5.	Elements of Database Programming. Event control, database procedures. database interfaces.

Learning activities

Activities	Explanation
Attendance	According to VGU regulation.
Individual Assignments	None
Group work	None
Online Activities	None
Self-study	90 hours
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Exams

- Final written exam 90 minutes.
- No materials, reference are allowed in the final exam room.

Grading policy

Assessment method	Percentage of total	Assessment date
Final exam	100	
Total	**100**	

Module materials

Required texts

Recommended texts

1. Lemahieu W., Broucke v. S., Baesens B. Principles of Database Management: The Practical Guide to Storing, Managing and Analyzing Big and Small Data. 1st Edition. Cambridge University Press. (2018)

2. Date, C.J., An Introduction to Database Systems. 8th Edition. Addison-Wesley (2003)

3. Ramakrishnan, R. and Gehrke, J. Database Management Systems. 3rd Edition McGraw-Hill (2003)

Written/updated by

Assoc. Prof. Manuel Clavel

Date: 19 / 5 /2021

61CSE217 Computer Network - 1

MODULE DESCRIPTION

Module title **Computer Network - 1**
Module code **61CSE217**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Dr. Tuan-Duc NGUYEN	duc.nt@vgu.edu.vn	A109	TBA
Lecturer	Assoc. Prof. Dr. Tuan-Duc NGUYEN	duc.nt@vgu.edu.vn	A109	TBA
Tutorial				None
Lab				None
Other	None			

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 3

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Intended learning outcomes

On successful completion of this module the learner will be able to:

1. Knowledge about fundamental concepts of computer systems and their interconnection via computer networks
2. Knowledge and understanding of basic concepts of communication protocols and their use in computer networks
3. Understand and analyze the specification and design aspect of computer network layers (OSI and TCP/It model)
4. Extracurricular skills are acquired: working in groups, structured problem solving, group-work and communication skills.

Contents

No.	Topic
1.	Introduction to Computer Networks
2.	Data transmission
3.	OSI - reference model
4.	Local networks
5.	LAN - Extensions
6.	Internet
7.	Routing, bridging, switching
8.	Wirelss LAN: IEEE 802 family protocols
9.	ARP, IPv4, IPv6, TCP, HTTP, DNS, etc.

Learning activities

Activities	Explanation
Attendance	Students should attend 100%.
Individual Assignments	3-4 assignments are given to test students' learning and development.
Group work	Group of 4-5 students for a group assigment and Seminar
Online Activities	VGU's e-learning platform for student discussion and share on topics, group and individual works.
Self-study	Students are recommended for seldf-study
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Assignments: 4-5 assignments (Homeworks and Quiz)

Exams: One final examination: 90 minutes

Grading policy

Assessment method	Percentage of total	Assessment date
Assignments	20	One per 2 weeks
Project	20	Group report and presentation
Final exam	60	
Total	**100**	

Module materials

Required texts

1. B.A. Forouzan, Data Communications and Networking, . 4th Edition, Mc Graw Hill, 2007.
2. Andrew S. Tanenbaum and David J. Wetherall, Computer Networks, Pearson Education 2011.
3. James F. Kurose and Keith D. Ross, Computer Networking, Pearson Education, 2009.

Recommended materials

1. Lecturer hand out and documents.

Written/updated by
Assoc. Prof. Dr. Nguyen Tuan Duc
Date / /2021

MODULE DESCRIPTION

Module title **Operating System**
Module code **61CSE218**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Dr. Tran Hong Ngoc	ngoc.tth@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers			TBA
Exercise				TBA

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 3

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites
None

Applicability for other modules
Distributed Systems, Real-time Systems.

Intended learning outcomes

On successful completion of this module the learner will be able to:

1. Name and describe the fundamental concepts of computer systems, especially the task of operating systems.
2. Knowledge the basic concepts and methods for the implementation of operating systems.
3. Acquire the following extracurricular skills: working in groups in the lab, structured problem solving, English language skills.

Contents Selection from areas such as, but not limited to:

No.	Topic
1.	Processes and process management
2.	Memory management
3.	File systems
4.	Input/output devices

5.	Distributed operating systems
6.	Windows and Unix based operating systems
7.	System management and administration

Learning activities

Activities	Explanation
Attendance	Students are expected to attend all classes. Attendance check is conducted at the beginning of the classes. There is no grade for attendance check.
Exercises/ Homework	During or after each lecture.
Lab	Students work in the groups in the lab.

Mode of assessment:

Practice Examination:

- In the lab.
- Duration: Min. 30 minutes, Max. 90 minutes.

Final Examination:

- Duration: 90 minutes

Grading policy:

Assessment method	Percentage of total	Assessment date
Practice Examination	30	
Final Examination	70	
Total	**100**	

Module materials

Required Text

1. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvi, Greg Gagne, 10th edition, Wiley. 2021, ISBN-13 : 978-1119800361.

Recommended texts

1. Andrew S. Tanenbaum, Herbert Bos , Modern Operating Systems, 4th edition, Pearson, 2014, ISBN-13 : 978-0133591620.
2. William Stallings, Operating Systems: Internals and Design Principles, 8th edition, Pearson. 2017, ISBN-13 : 978-0133805918.
3. Erich Ehses et al., Betriebssysteme, Pearson Studium. 2011, ISBN-13 : 978-3834814180.
4. Christian Baun, Betriebssysteme kompakt, Springer Vieweg. 2017.

Written/updated by
Dr. Tran Hong Ngoc
Date 22/05/2022

MODULE DESCRIPTION

Module title **Software Engineering - 2**
Module code **61CSE219**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Manuel Clavel	manuel.clavel@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers			TBA
Exercise				TBA

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 4

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Applicability for other modules

This module is the natural continuation of the module “Software Engineering- Analysis”.

Intended learning outcomes

- Knowledge and mastering of the basic principles and concepts of software design and implementation
- Capability to critically assess and estimate the usage of the various methods of software design in the application development context
- Understanding the roles of software developers and project managers
- Enhanced proficiency in the software engineering of large software systems

Extracurricular skills (20% of total workload): project- and teamwork, methods of project management, presentation techniques, ability to judge, English as the language of software engineering, socio-cultural importance of Computer Science, systems analysis and design, working in international teams

Contents

No.	Topic
1.	Software design concepts. Modularity. Object-oriented design concepts.
2.	Architectural design. Architectural styles. Architectural design for Web Apps and Mobile Apps.
3.	Component-level design. Design principles. Cohesion. Coupling. Design for reuse.
4.	Pattern-based design. Design patterns. Architectural patterns. Component-based design patterns.
5.	Software testing. Design for test.

Learning activities

Activities	Explanation
Attendance	According to VGU regulation.
Individual Assignments	None
Group work	Teamwork in small groups
Online Activities	None
Self-study	90 hours
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Exams

- Final written exam 90 minutes.
- Prerequisites for module examination: successful completion of the group work.
- No materials, reference are allowed in the final exam room.

Grading policy

Assessment method	Percentage of total	Assessment date
Final exam	100	
Total	**100**	

Module materials

Required texts

Recommended texts

1. Software Engineering: A Practitioner's Approach. 9th Edition. Roger S. Pressman and Bruce Maxim. Mcgraw-Hill Higher Education. (2020)
2. Software Engineering. 10th Edition. Iam Sommerville. Pearson. (2015)
3. Design Patterns: Elements of Reusable Object-Oriented Software. Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides. Addison-Wesley Professional. (1994)

Written/updated by

Assoc. Prof. Manuel Clavel

Date: 19 / 5 /2021

MODULE DESCRIPTION

Module title **Distributed System**
Module code **61CSE220**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Dr. Quang-Vinh DINH	vinh.dq2@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers			TBA
Exercise				TBA

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 4

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

Java Technologies

Intended learning outcomes

The students will acquire the theoretical basics for implementing distributed applications with heterogeneous technologies which are used within the industry. The students will continuously improve their understanding by implementing practical examples, thereby acquiring practical skills as well. This includes the installation of SW components on PCs and configuration accordingly. The students can assess different technologies and decide upon their benefits in concrete application contexts in order to have the ability to design suitable applications themselves.

Thus, the students acquire competency in solving problems in developing distributed applications on the basis of a sound theoretical foundation.

In addition, the following extracurricular skills are acquired: usage of frameworks and libraries, structured and creative problem solving, technical terminology and English.

Contents

No.	Topic
1.	Sockets as a base technology for distributed applications
2.	Message queues
3.	Object-oriented middleware-technologies (RPC and RMI in Java)
4.	Web Services, REST
5.	Fault tolerance
6.	Techniques for user interfaces
7.	Techniques for coupling databases
8.	Block chain

Learning activities

Activities	Explanation
Attendance	Recommendation
Individual Assignments	3-4 assignments
Group work	Project work (6 weeks)
Online Activities	VGU's e-learning platform for student discussion and share on topics, group and individual works.
Self-study	Students are recommended for self-learning and research
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Exams

Project work (6 weeks). The students have to develop a DS application that uses DS technologies such as RMI and Java web services.

Grading policy

Assessment method	Percentage of total	Assessment date
Assignments	20	
Project	80	
Total	**100**	

Module materials

Required texts

Recommended texts

1. Maarten van Steen: Distributed Systems. 2017
2. George Coulouris, Jean Dollimore, and Tim Kindberg. Verteilte Systeme. Konzepte und Design. Pearson Studium, 3., überarb. a. edition, 2005.
3. Dehnhardt, W.: „Java und Datenbanken: Anwendungsprogrammierung mit JDBC, Servlets und JSP“, Hanser-Verlag, München
4. Deitel, H.M., et.al.: „Advanced Java 2 Platform - How to Program“, Prentice Hall, Upper Saddle River, NJ 07458
5. Eberhardt, A., et.al.: „Java-Bausteine für E-Commerce-Anwendungen: Verteilte Anwendungen mit Servlets, CORBA und XML“, Hanser-Verlag, München
6. Ulrike Hammerschall. Verteilte Systeme und Anwendungen - Architekturkonzepte. Standards und Middleware-Technologien. Pearson Studium
7. Hofmann, J., et al.: Programmieren mit COM und CORBA“, Hanser-Verlag

Written/updated by

Dr. Dinh Quang Vinh

Date: 25 / 05 /2021

MODULE DESCRIPTION

Module title **Realtime System**
Module code **61CSE221**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Dr. Tuan-Duc NGUYEN	duc.nt@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers			TBA
Exercise				TBA

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 4

Student workload

Credits	5	ECTS
Lecture contact hours	30	AHs
Lab contact hours	30	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Intended learning outcomes

On successful completion of this module the learner will be able to have:

1. The scope of programming, technical and mobile systems time-dependent operations play an important role.
2. Real time scheduling as well as the integration of actuators and sensors.
3. The ability to model and implement realtime systems is taught. A goal is the ability to model and program time-dependent procedures, within a system and the communication with external devices.
4. Extracurricular skills will be acquired: group work in the laboratory, structured problem solving, creative problem-solving, communication skill.

Contents

No.	Topic
1.	The subject of the lecture is the development of time-dependent systems. It consists of modeling, simulation, implementation and testing of realtime systems. The following topics will be covered: - Real time behavior - Real time behavior - Synchronous and asynchronous events - Modelling of realtime systems - Parallelism and synchronisation - Interprocess communication - Reliability, redundancy, fault tolerance - Operating systems for realtime programming - Bus systems for real time computers
2.	Laboratory Realtime Systems - Examples on the lecture topics - Application using embedded kits - Group working on a project

Learning activities

Activities	Explanation
Attendance	Students should attend 100%.
Individual Assignments	Regular assignments are given to test students' learning and development.
Group work	None
Online Activities	VGU's e-learning platform for student discussion and share on topics, group and individual works.
Self-study	Students are recommended for seldf-study
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Assignments: 3-4 assignments (Homeworks and Quiz)

Exams: One final examination: 90 minutes

Grading policy

Assessment method	Percentage of total	Assessment date
Assignments	20	One per 2 weeks
Lab project	20	
Final exam	60	
Total	**100**	

Module materials

Required texts

1. Stuart Bennett: Real-Time Computer Control, Prentice Hall, 1994
2. Liu, Jane W. S.: Real-time systems. Prentice Hall, 2000.

Recommended materials

1. Lecturer hand out and material.

Written/updated by
Assoc. Prof. Nguyen Tuan Duc
Date / /2021

MODULE DESCRIPTION

Module title **IT Security**
Module code **61CSE222**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Dr. Tran Hong Ngoc	ngoc.tth@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers			TBA
Exercise				TBA

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 4

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Applicability for other modules

None

Intended learning outcomes

On successful completion of this module the learner will be able to:

1. Comprehend fundamental concepts of IT Security.
2. Develop a consciousness for IT Security aims and risks.
3. Analyze security mechanisms and their applicability with respect to exemplary scenarios.
4. Develop basic solutions, concepts and methods to implement IT Security and assess security risks in simple scenarios.
5. Acquire following extracurricular skills such as: structured problem solving, English language skills, economic and social impact of IT Security.

Contents:

Selection from areas such as, but not limited to:

No.	Topic
1.	Cryptographical Principles and Methods
2.	Authentication
3.	Operating System Security
4.	Application Security
5.	Security Risks
6.	Network Security
7.	Firewalls
8.	Virtual Private Networks
9.	Network Surveillance
10.	Availability
11.	Network Applications
12.	Security of Real-time Communications
13.	Local Network Security
14.	Network Security Standards
15.	Practical Implications
16.	Current Research Topics

Learning activities

Activities	Explanation
Attendance	Students are expected to attend all classes. Attendance check is conducted at the beginning of the classes. There is no grade for attendance check.
Exercises/ Homework	During or after each lecture.

Mode of assessment

Final Examination

- Written examination (duration 90 minutes)

Grading policy

Assessment method	Percentage of total	Assessment date
Final Examination	100	
Total	**100**	

Module materials

Recommended texts

1. Martin Kappes, Netzwerk- und Datensicherheit, Teubner Verlag, Wiesbaden, 2007.
2. Claudia Eckert, IT-Sicherheit: Konzepte, Verfahren, Protokolle, Oldenbourg-Verlag, München, 2009.
3. Schneier, Bruce. Applied Cryptography, Second Edition, John Wiley & Sons, 20th Edition. 2015, ISBN-13 : 978-1119096726.
4. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Security in Computing, 5th Edition, Pearson, 2015, ISBN-13 : 978-0134085043.
5. Chwan-Hwa (John) Wu, J. David Irwin, Introduction to Computer Networks and Cybersecurity. 2013, ISBN-13 : 978-1466572133.
6. J. Michael Stewart, Network Security, Firewalls And VPNs, Jones & Bartlett Learning, 2nd Edition, 2013, ISBN-13 : 978-1284031676.
7. Tari Schreider, Cybersecurity Law, Standards and Regulations, Rothstein Publishing, 2nd edition. 2020, ISBN-13 : 978-1944480561.
8. Original NIST, IETF, IEEE and ITU Standards.
9. Original standards and research papers.

Written/updated by
Dr. Tran Hong Ngoc
Date 21/05/2021

MODULE DESCRIPTION

Module title **Computer Network - 2**
Module code **61CSE223**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Dr. Tuan-Duc NGUYEN	duc.nt@vgu.edu.vn	A109	TBA
Lecturer	Assoc. Prof. Dr. Tuan-Duc NGUYEN	duc.nt@vgu.edu.vn	A109	TBA
Tutorial				None
Lab				None
Other	None			

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 4

Student workload

Credits	5	ECTS
Contact hours (Lecture)	30	AHs
Contact hours (Lab)	30	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Intended learning outcomes

On successful completion of this module the learner will be able to:

1. Know and understand of basic concepts of communication protocols and their use in computer networks
2. Know and understand of telephonemobile and Internet of Things networks
3. Analyze the new trend and applications of Computer network
4. Set up computer networks and computer network applications
5. Apply network surveillance technologies for debugging,
6. Performance analysis and problem mitigation
7. Extracurricular skills are acquired: Lab experiences, working in groups in the lab, structured problem solving, research skill, communication and working English skills.

Lecture Contents

No.	Topic
1.	- Network management - IP Cellular telephone mobile network (3G/4G) - Network of Internet of Things
2.	Project on current applications in Computer and Communication network

Lab contents

No.	Topic
1.	Set-up and Configuration of LAN
2.	Set-up and Configuration of Wireless LAN
3.	Network data transmission using Socket Programming
4.	Application of network management, performance analysis and Security

Learning activities

Activities	Explanation
Attendance	Students should attend 100%.
Individual Assignments	3-4 assignments are given to test students' learning and development.
Group work	Group of 4-5 students for a group assigment and Seminar
Online Activities	VGU's e-learning platform for student discussion and share on topics, group and individual works.
Self-study	Students are recommended for seldf-study
Internship	None
Lab or Workshop	Yes
Field Work	None

Mode of assessment

Assignments: (Homeworks and Quiz)

Lab Assignments: Evaluation of Lab day

Project: Group of 4-5 students for a group assigment and Seminar

Grading policy

Assessment method	Percentage of total	Assessment date
Assignments	20	One per 2 weeks
Project	40	Group report and presentation
Lab assignments	40	
Total	**100**	

Module materials

Required texts

1. B.A. Forouzan, Data Communications and Networking, . 4th Edition, Mc Graw Hill, 2007.
2. Andrew S. Tanenbaum and David J. Wetherall, Computer Networks, Pearson Education 2011.
3. James F. Kurose and Keith D. Ross, Computer Networking, Pearson Education, 2009.

Recommended materials

1. Lecturer hand out and documents.

Written/updated by
Assoc. Prof. Dr. Nguyen Tuan Duc
Date / /2021

MODULE DESCRIPTION

Module title **Programming Exercises**
Module code **61CSE224**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Manuel Clavel	manuel.clavel@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers			TBA
Exercise				TBA

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 4

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

For module **participation**

Passed examination for modules “OO Programming” and “Databases”.

Intended learning outcomes

- Students are able to implement a realistic application covering aspects of distributed systems and a RDBMS. To this end, they work in project teams and apply techniques from software engineering. Students can apply basic IT-project management skills.
- In addition to this, the students acquire the following extracurricular skills: project work, self organization, English

Contents

No.	Topic
1.	Consolidation of software development and engineering using suitable tools.
2.	Know-how acquired in programming, software engineering, databases and distributed systems is used and applied to a realistic Web Application.
3.	Engineering the requirements, analysis, design, implementation and testing of a realistic Web Application.

Learning activities

Activities	Explanation
Attendance	According to VGU regulation.
Individual Assignments	None
Group work	Teamwork in groups
Online Activities	None
Self-study	None
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Final Report

Written project report and oral presentation (min. 15 min, max. 20 min)

Grading policy

Assessment method	Percentage of total	Assessment date
Project report	85	
Oral presentation	15	
Total	**100**	

Module materials

Required texts

Recommended texts

Current and specific literature information will be announced by the lecturer in the beginning of the semester.

Written/updated by

Assoc. Prof. Manuel Clavel

Date: 19 / 5 /2021

MODULE DESCRIPTION

Module title **Current Topics in Computer Science**
Module code **61CSE325**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Dr. Tuan-Duc NGUYEN	duc.nt@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers			TBA
Tutorial				None
Lab				None
Other	None			

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 5

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each semester/each academic year

Prerequisites

None

Intended learning outcomes

On successful completion of this module the learner will be able to:

1. Know and understand the new research and application topics in Computer Science
2. Analyse the affect and benefit of comtemporary topics of Computer Science and Information Technology in Industry and social life.
3. Ability to independently work on new issues concerning Computer Sciences.
4. Extracurricular skills are acquired: working skill in a group, structured problem solving, research skill, communication and presentation skills.

Lecture Contents

No.	Topic
1.	Lecture of Current Topics in Computer Science
2.	Group Project: Group Project and Seminar of Current Topics in Computer Science

Learning activities

Activities	Explanation
Attendance	Recommendation
Individual Assignments	None
Group work	Group of 4-5 students for a group assigment and Seminar
Online Activities	VGU's e-learning platform for student discussion and share on topics, group and individual works.
Self-study	Students are recommended for self learning and research
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Project and Seminar: Group of 4-5 students for a group assigment and Seminar

Exams: One final examination: 90 minutes

Grading policy

Assessment method	Percentage of total	Assessment date
Project and Seminar	50	
Final exam	50	
Total	**100**	

Module materials

Recommended materials

1. Lecturer hand out and documents.

Written/updated by
Assoc. Prof. Dr. Nguyen Tuan Duc
Date / /2021

MODULE DESCRIPTION

Module title **Project**
Module code **61CSE326**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Manuel Clavel	manuel.clavel@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers			TBA
Exercise				TBA

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 5

Student workload

Credits	10	ECTS
Contact hours	120	AHs
Assignments and independent learning	180	AHs
Total Working hours	300	AHs

Frequency The module is offered each academic year

Prerequisites

For module **participation**:

1. Successful participation in modules "Software Engineering – Analysis" or "Software Engineering – Design"
2. A minimum of 80 credits acquired in the first 4 semesters

Intended learning outcomes

- Improvement of the technical abilities for programming, documentation, SW engineering, presentation and communication.
- Improvement of technical abilities in one or more areas of the curriculum (e.g. networks, distributed applications, etc.)

In addition, the following extracurricular skills are acquired

- Gaining project experience (i.e. developing the ability to reach a goal within a limited period of time). Gathering of experience by working in a team
- Developing time management skills
- Developing the ability to communicate with others at a high technical level

- Overcoming unexpected difficulties (of technical as well as social nature)
- Tolerance toward project partners.
- Taking responsibility

Contents

No.	Topic
1.	Project management of a realistic software development project, including: ● Effort estimation ● Schedule and resource estimation ● Quality Planning ● Risk management ● Project monitoring
2.	Tools, technologies, frameworks, and platforms for developing a realistic software project in: ● Cloud Computing ● Mobile Computing ● Machine Learning ● Big Data ● Internet of Things (Notice that the above list is non-exhaustive.)

Learning activities

Activities	Explanation
Attendance	According to VGU regulation.
Individual Assignments	Working in groups and individually depending on assignments allocated in the project discussions
Group work	Teamwork in groups. Regular (weekly) project discussions with work package assignments and presentation of results, etc.
Online Activities	None
Self-study	None
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Final Report

Project work and presentation (min. 15 min. and max. 20 min.)

Grading policy

Assessment method	Percentage of total	Assessment date
Active participation	50	
Project report	35	
Oral presentation	15	
Total	**100**	

Active participation, which is documented either by laid down SW code or SW documentation or laid down documentation of the project management/progress or written down research results that contribute to the progress of the project or other written documents which show relevance to the progress of the project relevance (e.g. quality assurance documents) and Presentation of own results at least one of the project meetings and regular (weekly) reporting of the own progress (assigned work packages) in the project meetings with discussion contributions and work package assignment

Module materials

Required texts

Recommended texts

Current and specific literature information will be announced by the lecturer in the beginning of the semester.

Written/updated by

Assoc. Prof. Manuel Clavel

Date: 19 / 5 /2021

MODULE DESCRIPTION

Module title **Data mining**
Module code **61CSE327.1**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Dr. Tran Hong Ngoc	ngoc.tth@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers			TBA
Exercise				TBA

Classification ☐ Compulsory ☐ Compulsory optional ☒ Optional/Elective

Semester 5

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Intended learning outcomes

On successful completion of this module the learner will be able to:

1. Comprehend concepts and techniques in Data Mining.
2. Develop skills of using recent data mining software for solving practical problems.
3. Develop technical and analytical skills on big data.
4. Acquire following extracurricular skills such as: structured problem solving, English language skills, economic and social impact of Data Mining.

Contents Selection from areas such as, but not limited to:

No.	Topic
1.	Data knowledge and discovery
2.	Data warehousing
3.	Data understanding
4.	Data preparation/cleansing
5.	Clustering
6.	Classification, Regression
7.	Association Rules, Pattern Mining
8.	Outlier Detection
9.	Time Series
10.	Sequential Pattern Mining
11.	Data Privacy and Ethics
12.	Anomaly Detection
13.	Big Data and Cloud Computing
14.	Current Research Topics

Learning activities

Activities	Explanation
Attendance	Students are expected to attend all classes. Attendance check is conducted at the beginning of the classes. There is no grade for attendance check.
Exercises /Homework	During and after each lecture
Project	Students work in groups on given projects.
Group	Students work in groups on given projects.
Lab	Students work in the lab on exercises, assignments, projects.

Mode of assessment

Group Project

- Report: submitted on the final exam day.
- Interview: lecturers interview the selected groups in need.

Final Exam

- Duration: 90 minutes

Grading policy:

Assessment method	Percentage of total	Assessment date
Project Report	30	
Final Exam	70	
Total	**100**	

Module materials

Required Texts

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar. Introduction to Data Mining, 2nd Edition, Pearson, 2018. ISBN-13 : 978-0133128901.
2. Michael R. Berthold, Christian Borgelt, Frank Höppner, Frank Klawonn, Rosaria Silipo, Guide to Intelligent Data Science: How to Intelligently Make Use of Real Data, 2nd edition, 2020, ISBN-13 : 978-3030455736.
3. Charu C. Aggarwal, Data Mining: The Textbook, 2015th Edition, Springer, ISBN-13 : 978-3319141411.

Recommended texts

1. Jake VanderPlas, Python Data Science Handbook: Essential Tools for Working with Data, O'Reilly Media, 1st Edition, 2016, ISBN-13 : 978-1491912058.
2. D. Hand, H. Mannila, P. Smyth, Principles of Data Mining, 1st Edition, Prentice Hall of India, 2008, ISBN-13 : 978-8120324572.

Written/updated by
Dr. Tran Hong Ngoc
Date 24/05/2021

MODULE DESCRIPTION

Module title **Medical Image Processing**
Module code **61CSE327.2**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Huynh Trung Hieu	hieu.ht@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers	-	-	TBA
Exercise				TBA

Classification ☐ Compulsory ☐ Compulsory optional ☒ Optional/Elective

Semester 5

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

Programming ability, familiarity with data structure, algorithms, and machine learning/statistics.

Applicability for other modules

Applicable to other Computer Science Bachelor programmes

Intended learning outcomes

This course focuses on overview of medical image formation, storage, and image processing techniques in support of diagnoses and therapy. It starts with an introduction to medical imaging modalities and acquisition. The presprocessing techniques including image enhancement, transformation, noise reduction will be introduced. Different techniques for medical image analysis including segmentation and registration will be discussed.

By the end of the course, the students should be able to:

- Recognize basics of radiological images, imaging, and their clinical use.
- Describe image enhancement methods and preprocessing algorithms.
- Demonstrate different methods for medical image analysis.
- Explain the basic principles of medical image communication.
- Effectively function on teams to accomplish a common goal.

Contents

No.	Topic
1.	Basics of radiological images, imaging, and clinical use
2.	Image processing, enhancement
3.	Medical image registration/alignment
4.	Medical image segmentation
5.	Medical image visualization
6.	Machine learning for medical imaging
7.	Medical image communication.

Learning activities

Activities	Explanation
Attendance	According to VGU regulation.
Individual Assignments	Tasks and examples on the topics The exercises serve to ensure that the students learn to deal with the concepts learned in the lecture and to be able to apply these concepts in concrete examples.
Group work	Teamwork in groups on assignments or projects.
Online Activities	None
Self-study	90 hours
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Final report
Project work and presentation (min. 15 min. and max. 30 min.)

Grading policy

Assessment method	Percentage of total	Assessment date
Active participation	50	
Project report	35	
Oral Presentation	15	
Total	**100**	

Module materials

Required texts

Recommended texts

6. . M. Sonka, V. Hlavac, R. Boyle, Image Processing, Analysis, and Machine Vision, CL.
7. J. Hajnal, D. Hill, Medical Image Registration. CRC Press.

Written/updated by

Assoc. Prof. Huynh Trung Hieu

Date: 19 / 5 /2021

MODULE DESCRIPTION

Module title **IoT Application**
Module code **61CSE327.3**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Dr. Tuan-Duc NGUYEN	duc.nt@vgu.edu.vn	A109	TBA
Lecturer	Assoc. Prof. Dr. Tuan-Duc NGUYEN	duc.nt@vgu.edu.vn	A109	TBA
Exercise				TBA

Classification ☐ Compulsory ☐ Compulsory optional ☒ Optional/Elective

Semester 5

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Intended learning outcomes

On successful completion of this module the learner will be able to:

1. Knowledge and understanding of different concepts of IoT device and IoT network
2. Knowledge and understanding of different specification and design aspect of IoT smart devices, and IoT network standards.
3. Analyze and design an IoT aplication: Sensors, IoT smart devices, IoT network, Data service and Data processing.
4. Develop an IoT application using different IoT Kits and Software development tools.
5. Design and apply an IoT application to solve a real life problem in Agriculture, Smart City or Industry applications.
6. Extracurricular skills are acquired: working skill in a group, structured problem solving, research skill, communication and presentation skills.

Lecture Contents

No.	Topic
1.	- Introduction to Internet of Things (IoT) - Wireless Personal Area Network - Wireless Sensor Network - IoT over Cellular Telephone network - IoT Hardware and Platform - Database and Data Service for IoT
2.	Group Project: Design and develop a IoT Applications in Agriculture, Smart City or Industry applications.

Learning activities

Activities	Explanation
Attendance	Recommendation
Individual Assignments	3-4 assignments are given to test students' learning and development.
Group work	Group of 4-5 students for a group assigment and Seminar
Online Activities	VGU's e-learning platform for student discussion and share on topics, group and individual works.
Self-study	Students are recommended for self learning and research
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Assignments: 4-5 assignments (Homeworks and Quiz)
Exams: One final examination: 90 minutes
Grading policy

Assessment method	Percentage of total	Assessment date
Assignments	20	
Project	40	
Final exam	40	
Total	**100**	

Module materials

Required texts

1. IoT Application
2. Embedded Programming

Recommended materials

1. Lecturer hand out and documents.

Written/updated by
Assoc. Prof. Dr. Nguyen Tuan Duc
Date / /2021

MODULE DESCRIPTION

Module title **Mobile Application**
Module code **61CSE328.1**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Dr. Tuan-Duc NGUYEN	duc.nt@vgu.edu.vn	A109	TBA
Lecturer	Assoc. Prof. Dr. Tuan-Duc NGUYEN	duc.nt@vgu.edu.vn	A109	TBA
Exercise				TBA

Classification ☐ Compulsory ☐ Compulsory optional ☒ Optional/Elective

Semester 5

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Intended learning outcomes

On successful completion of this module the learner will be able to:

1. Knowledge and understanding of Data service of 3G/4G telephone mobile system and mobile application in different fields.
2. Analyze and design different aspects of a mobile aplication: User interface, Database, development environment.
3. Develop a mobile application in Android and iOS using different development tool.
4. Design and apply a mobile application to solve a real life problem.
5. Extracurricular skills will be acquired: group work in project, structured problem solving, creative problem solving, research skill, communication and presenation skills.

Lecture Contents

No.	Topic
1.	- Introduction to Data Service of 3G/4G mobile telephone system - Overview of mobile application in different fiedls - Operting system: Android and iOs for Mobility Devices - Development environment for Androis and iOS - Database for mobile devices - User Interface design for mobile devides
2.	Group Project: - Design a mobile application - Develop a mobile application on Android/iOS

Learning activities

Activities	Explanation
Attendance	Recommendation
Individual Assignments	Assignments are given to test students' learning and development.
Group work	Group of 4-5 students for a group assigment and Seminar
Online Activities	VGU's e-learning platform for student discussion and share on topics, group and individual works.
Self-study	Students are recommended for self learning and research
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Assignments: 3 assignments (Homeworks and Quiz)

Project (with Seminar): 1 Group Project of 4-5 students

Exams: One final examination: 90 minutes

Grading policy

Assessment method	Percentage of total	Assessment date
Assignments	20	One per 2 weeks
Project	40	
Final exam	40	
Total	**100**	

Module materials

Required texts

1. DIMARZIO, Jerome. Beginning Android Programming with Android Studio. John Wiley & Sons, 2016 .
2. BLUNDELL, Paul; MILANO, Diego Torres. Learning Android Application Testing. Packt Publishing Ltd, 2015.

Recommended materials

1. Lecturer hand out and documents.

Written/updated by
Assoc. Prof. Dr. Nguyen Tuan Duc
Date / /2021

MODULE DESCRIPTION

Module title **Machine Learning**
Module code **61CSE327.4**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Dr. Quang-Vinh DINH	vinh.dq2@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers			TBA
Exercise				TBA

Classification ☐ Compulsory ☐ Compulsory optional ☒ Optional/Elective

Semester 5

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

Java and statistics

Intended learning outcomes

After successful completion of the programmes, the students have the following core competencies:

- Understand important concepts and algorithms and their applications in real projects.
- Design a correct method to collect and pre-process data for a machine learning algorithm.
- Analyse data from real contexts and suggest appropriate solutions.
- Master Python-based libraries to design and analyse data as well as train machine learning based models
- Apply machine learning for solving real problems

The following extracurricular skills are acquired: concept formation, structured problem solving, creative problem solving and command of methods for error detection and elimination. Capacity for teamwork by means of cooperation in groups and the ability to accept criticism and conflicts respectively as well as reflecting capacity, communication, connection of theory and practice.

Contents

No.	Topic
1.	Python and Numpy
2.	Overview of machine learning and applications
3.	Linear regression
4.	Applications of linear regression to the problems of house price prediction and advertising-based sales prediction
5.	Logistic regression
6.	Applications of logistic regression to the problems of flower and fruit classifications
7.	Support vector machine
8.	Applications to the problems of handwriting digit number and traffic sign classifications
9.	Unsupervised learning
10.	Applications to clustering and abnormal detection

Learning activities

Activities	Explanation
Attendance	Recommendation
Individual Assignments	3-4 assignments
Group work	Project work (6 weeks)
Online Activities	VGU's e-learning platform for student discussion and share on topics, group and individual works.
Self-study	Students are recommended for self-learning and research
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Exams
Project work (6 weeks). The students have to develop a machine learning application to solve a real problem.

Grading policy

Assessment method	Percentage of total	Assessment date
Assignments	20	
Project	80	
Total	**100**	

Module materials

Required texts

Recommended texts

1. Yaser Abu Mostafa, Malik Magdon-Ismail, and Hsuan-Tien Lin: Learning from Data: A Short Course. AMLBook, 2012.
2. Christopher M. Bishop: Pattern Recognition and Machine Learning. Springer, 2006.

Written/updated by

Dr. Dinh Quang Vinh

Date: 25 / 05 /2021

MODULE DESCRIPTION

Module title **Advanced Artificial Intelligence**
Module code **61CSE328.2**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Dr. Quang-Vinh DINH	vinh.dq2@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers			TBA
Exercise				TBA

Classification ☐ Compulsory ☐ Compulsory optional ☒ Optional/Elective

Semester 5

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

Java and statistics

Intended learning outcomes

After successful completion of the programmes, the students have the following core competencies:

- Design and train a deep learning model for a problem
- Understand different architectures of existing models
- Use Tensorflow library to implement deep learning algorithms
- Apply deep learning for solving real problems

The following extracurricular skills are acquired: concept formation, structured problem solving, creative problem solving and command of methods for error detection and elimination. Capacity for teamwork by means of cooperation in groups and the ability to accept criticism and conflicts respectively as well as reflecting capacity, communication, connection of theory and practice.

Contents

No.	Topic
1.	Overview of deep learning and computer vision
2.	Linear and logistic regression
3.	Softmax regression
4.	Multilayer perceptron
5.	Convolutional neural network (CNN)
6.	Training a CNN model
7.	Model generalization
8.	Image domain conversion
9.	Transfer learning
10.	Segmentation
11.	Object detection

Learning activities

Activities	Explanation
Attendance	Recommendation
Individual Assignments	3-4 assignments
Group work	Project work (6 weeks)
Online Activities	VGU's e-learning platform for student discussion and share on topics, group and individual works.
Self-study	Students are recommended for self-learning and research
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Exams

- Project work (6 weeks). The students have to develop an application to solve a real problem using deep learning and computer vision algorithms.

Grading policy

Assessment method	Percentage of total	Assessment date
Assignments	20	
Project	80	
Total	**100**	

Module materials

Required texts

Recommended texts

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville: Deep Learning. MIT Press, 2016.
2. Michael Nielsen: Neural Networks and Deep Learning. http://neuralnetworksanddeeplearning.com/, 2019.
3. François Chollet: Deep Learning with Python. Manning, 2017.

Written/updated by

Dr. Dinh Quang Vinh

Date: 25 / 05 /2021

MODULE DESCRIPTION

Module title **Advanced IT Security**
Module code **61CSE328.3**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Dr. Tran Hong Ngoc	ngoc.tth@vgu.edu.vn	A109	TBA
Lecturer	CS Lecturers			TBA
Exercise				TBA

Classification ☐ Compulsory ☐ Compulsory optional ☒ Optional/Elective

Semester 5

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites
None

Intended learning outcomes
On successful completion of this module the learner will be able to:

1. Develop the consciousness for IT security aims and risks.
2. Comprehend advanced concepts and develop solutions, methods to implement IT Security.
3. Acquire knowledge and techniques in modern topics in IT Security.
4. Achieve extracurricular skills such as: structured problem solving, English language skills, economic and social impact of IT Security.

Contents: Selection from areas such as, but not limited to:

No.	Topic
1.	Cryptology
2.	Complexity Theory
3.	Practical Network Security Exercises
4.	Secure Programming
5.	Buffer Security
6.	Anomaly Detection
7.	Network Security Protocols
8.	Penetration Testing
9.	Data Privacy

No.	Topic
10.	Forensics
11.	Biometrics
12.	Blockchain
13.	Current Research Topics

Learning activities

Activities	Explanation
Attendance	Students are expected to attend all classes. Attendance check is conducted at the beginning of the classes. There is no grade for attendance check.
Exercises/ Homework	During or after each lecture.

Mode of assessment

Final Examination

- Written examination (duration 90 minutes)

Grading policy

Assessment method	Percentage of total	Assessment date
Final Examination	100	
Total	**100**	

Module materials

Recommended texts

1. Jörg Rothe, Complexity Theory and Cryptology: An Introduction to Cryptocomplexity, 1st ed. Springer. 2005, ISBN-13 : 978-3642060540.
2. Ross Anderson, Security Engineering. 2nd Edition. John Wiley and Sons. 2008, ISBN-13: 978-0470068526.
3. Chwan-Hwa (John) Wu, J. David Irwin, Introduction to Computer Networks and Cybersecurity 1st Edition. 2013, ISBN-13 : 978-1466572133.
4. Chuck Easttom, System Forensics, Investigation, and Response, Jones & Bartlett Learning, 3rd Edition. 2017, ISBN-13 : 978-1284121841.
5. Dhruba Kumar Bhattacharyya, Jugal Kumar Kalita, Network Anomaly Detection: A Machine Learning Perspective, Chapman and Hall/CRC, 1st Edition. 2013, ISBN-13 : 978-1466582088.
6. Georgia Weidman, Penetration Testing: A Hands-On Introduction to Hacking, No Starch Press, 1st Edition. 2014, ISBN-13 : 978-1593275648.
7. Original research papers and standards.

Written/updated by
Dr. Tran Hong Ngoc
Date 22/05/2021

61CSE329 General Study

MODULE DESCRIPTION

Module title **General Study**
Module code **61CSE329**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Dr. Dinh Hai Dung	dung.dh@vgu.edu.vn		TBA
Lecturer	Assoc. Prof. Dr. Tuan-Duc NGUYEN	duc.nt@vgu.edu.vn	A109	TBA
Exercise				TBA

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 5

Student workload

Credits	5	ECTS
Contact hours	60	AHs
Assignments and independent learning	90	AHs
Total Working hours	150	AHs

Frequency The module is offered each academic year

Prerequisites

None

Intended learning outcomes

On successful completion of this module, the students acquire the following extracurricular skills:

1. The ability to think in interdisciplinary terms and act cooperatively
2. Overcoming the limitations of their faculty-specific thought structures (theories and methods)
3. The ability to recognize scientific and technical, economic and legal, cultural, social and personal aspects by an exemplary cross-sectional topic and to balance and reflect on them comprehensively
4. Explicating the nexus of their faculty in the context of different scientific disciplines, as well as societal interests (communicate, present, discuss)
5. Reflecting the effects and consequences of their professional and societal activities and thus have the ability to deduct from this the consequences of their own actions.

Contents

No.	Topic
1.	The General Studies module forms the profile character of the interdisciplinary orientation. It is a module forming an interdisciplinary topic, where they are connected and integrated.
2.	Group project: - An interdisciplinary subject

Learning activities

Activities	Explanation
Attendance	Students should attend 100%.
Individual Assignments	Assignments are given to test students' learning and development.
Group work	Group of 4-5 students for a group assigment
Online Activities	VGU's e-learning platform for student discussion and share on topics, group and individual works.
Self-study	None
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

Assignments: Homeworks/Quiz

Project: general study group project

Grading policy

Assessment method	Percentage of total	Assessment date
Assignments	20	One per 2 weeks
Project	80	
Total	**100**	

Module materials

Recommended materials

1. Lecturer hand out and documents.

Written/updated by
Dr. Dinh Hai Dung
Date / /2021

61CSE330 Internship

MODULE DESCRIPTION

Module title **Internship**
Module code **61CSE330**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Dr. Tuan-Duc NGUYEN	duc.nt@vgu.edu.vn	B	9:00-11:00 AM, Mon to Fri
Lecturer	Supervisor in company; CS lecturers for internship evaluation		B	9:00-11:00 AM, Mon to Fri
Tutorial				None
Lab				None
Other	None			

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 6

Student workload

Credits	15	ECTS
Contact hours		AHs
Assignments and independent learning		AHs
Total Working hours	450	AHs

Frequency The module is offered each academic year

Prerequisites

Successful completion of modules in the first 5 semesters comprising 120 credit points.

Intended learning outcomes

On successful completion of this module the learner will be able to have:

1. The orientation in the desired professional field
2. The ability to conduct work responsibly in cooperation with others
3. The ability to assess unknown software systems
4. Insights into important application fields in Computer Science
5. Additionally, the following extracurricular skills are developed:
6. Understanding of the relevance of IT for the organisation and for society
7. The ability to independently develop a presentation on professional activities and hold this presentation using modern presentation techniques within a given timeframe.
8. The ability to create a multi-page report in an adequate format

Lecture Contents

No.	Topic
1.	Qualified participation in one or several small projects in the areas • System Analysis • Project work • Application programming • System programming
2.	Seminar for the Practical Training Phase Supervised Practical Training Project

Learning activities

Activities	Explanation
Attendance	Students should attend 100%. Attendance will be regulated and checked by the direct supervisor at the industrial company.
Individual Assignments	Tasks are assigned by the industrial company.
Group work	None
Online Activities	None
Self-study	None
Internship	At an industrial company in the field corresponding to the registered major
Lab or Workshop	None
Field Work	None

Mode of assessment

- Certificate of the Internship firm and the report presented on the performance of the Internship tasks.
- The Internship covers 3 months (5 days per week). The participation in the seminar on the Internship must be enabled by the firm.
- Internship Report and presentation (20 min. with a subsequent discussion).

Grading policy

Assessment method	Percentage of total	Assessment date
Internship Report	80	End of Internship
Presentation	20	End of Internship
Total	**100**	

Written/updated by
Assoc. Prof. Dr. Nguyen Tuan Duc
Date / /2021

61CSE399 Thesis with Colloquium

MODULE DESCRIPTION

Module title **Thesis with Colloquium**
Module code **61CSE399**
Study program **Computer Science (CSE)**

Module coordinator/Lecturer

Type	Lecturer	Email	Office	Office hours (if any)
Module Coordinator	Assoc. Prof. Dr. Tuan-Duc NGUYEN	duc.nt@vgu.edu.vn	B	9:00-11:00 AM, Mon to Fri
Lecturer	CS lecturers for thesis supervisor		B	9:00-11:00 AM, Mon to Fri
Tutorial				None
Lab				None
Other	None			

Classification ☒ Compulsory ☐ Compulsory optional ☐ Optional/Elective

Semester 6

Student workload

Credits	15	ECTS
Contact hours		AHs
Assignments and independent learning		AHs
Total Working hours	450	AHs

Frequency The module is offered each academic year

Prerequisites

Evidence of the internship registration with a signed training contract
Successful completion of all modules of the first 5 semesters.

Intended learning outcomes

The students acquire technical and interdisciplinary abilities to work as computer scientists.
The students have competencies in the areas techniques of scientific work, negotiation, assertiveness, presentation techniques, project management, conflict management, planning of new systems, networked thinking, creativity and transferability

Lecture Contents

No.	Topic
1.	Thesis topic is assigned by the supervisor after the discussion with student.
2.	Colloquium: Depend on the individual topic of the Bachelor Thesis

Learning activities

Activities	Explanation
Attendance	Thesis work can be conducted in university Lab or in industrial company. Attendance check is depended on the thesis supervisor.
Individual Assignments	Weekly report. Tasks are assigned by the thesis supervisor.
Group work	YES
Online Activities	None
Self-study	YES
Internship	None
Lab or Workshop	None
Field Work	None

Mode of assessment

- Bachelor Thesis (weighting 80%) and Colloquium (min. 30 min. and max. 60 min., weighting 20%)
- The colloquium requires the successful completion of the Bachelor Thesis.
- The thesis duration: 3 months

Grading policy

Assessment method	Percentage of total	Assessment date
Bachelor Thesis	80	
Colloquium	20	After the thesis report submission
Total	**100**	

Written/updated by
Assoc. Prof. Dr. Nguyen Tuan Duc
Date / /2021