MODULE HANDBOOK

PROGRAM LEVEL

BACHELOR OF ENGINEERING IN SPACE ENGINEERING

PROVIDED BY
INTERNATIONAL UNIVERSITY (IU),
VIET NAM NATIONAL UNIVERSITY HO CHI MINH CITY (VNUHCM)

OCTOBER, 2023

VIETNAM NATIONAL UNIVERSITY HCMC
INTERNATIONAL UNIVERSITY
Department of Physics
Space Engineering Program

MODULE HANDBOOK

HCMC, 2023

CONTENTS

GENERAL COURSES

BASIC SCIENCE KNOWLEDGE

1. General Physics 1 (PH019IU)

Course designation	*This subject will provide an introduction to mechanics including concepts and principles of kinetics, dynamics, energetics of motion of a particle and a rigid body and provide a basic knowledge of fluid mechanics; macroscopic description of gasses; heat and the first law of thermodynamics; heat engines and the second law of thermodynamics; microscopic description of gasses and the kinetic theory of gasses.*
Semester(s) in which the course is taught	1, 2, summer semester
Person responsible for the course	Assoc. Prof. Phan Bảo Ngọc Dr. Phan Hiền Vũ
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, assignment.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 170 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 50 Private study including examination preparation, specified in hours: 120
Credit points/ECTS	4 credits/6.16 ECTS
Required and recommended prerequisites for joining the course	None

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course students will be able to:<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Understand basic knowledge of kinematics, dynamics, and laws of conservation of a mechanical system.
CLO2. Understand basic knowledge of fluid mechanics, laws of thermodynamics, and the kinetic theory of an ideal gas.
CLO3. Apply knowledge of physics to solving problems in science and engineering</td></tr>
<tr><td>Skill</td><td>CLO4. Apply skills to analyzing and solving problems in science and engineering</td></tr>
<tr><td>Attitude</td><td>CLO5. Communicate effectively in writing manner</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (2 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Chapter 1: Bases of Kinematics</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Chapter 2: The Law of Motion</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Chapter 3: Work and Mechanical Energy</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Chapter 4: Linear Momentum and Collisions</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Chapter 5: Rotation of a Rigid Object About a Fixed Axis</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Chapter 6: Equilibrium and Elasticity</td><td>2</td><td>I</td></tr>
<tr><td>Chapter 7: Universal Gravitation</td><td>2</td><td>I</td></tr>
<tr><td>Chapter 1: Fluid Mechanics</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Chapter 2: Temperature, Heat, and the First Law of Thermodynamics</td><td>4</td><td>I, T,U</td></tr>
<tr><td>Chapter 3: The Kinetic Theory of Gasses</td><td>5</td><td>I, T,U</td></tr>
<tr><td>Chapter 4: Entropy and the Second Law of Thermodynamics</td><td>4</td><td>I, T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Exam</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	[1] Lecture Notes [2] Halliday D., Resnick R. and Walker, J. (2011) *Principles of Physics*, 9th edition, John Willey and Sons, Inc. [3] Alonso M. and Finn E.J. (1992) *Physics,* Addison-Wesley Publishing Company. [4] Faughn/Serway (2006) *Serway's College Physics*, Thomson Brooks/Cole.

2. General Physics 1 Lab (PH020IU)

Course designation	*This subject is an experimental course that provides students necessary skills to do experiment of mechanics, thermodynamics, and fluid mechanics.*
Semester(s) in which the course is taught	1, 2, summer semester
Person responsible for the course	MSc. Trịnh Thanh Thủy
Language	English
Relation to curriculum	Compulsory
Teaching methods	Experiment, writing report
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 110 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 50 Private study including examination preparation, specified in hours: 60
Credit points/ECTS	2 credits/4 ECTS
Required and recommended prerequisites for joining the course	Parallel course: General Physics 1 (PH019IU)

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Understand basic knowledge of law of conservations and dynamics of rigid body and of the kinetic energy of ideal gas and the second law of thermodynamics.</td></tr>
<tr><td>Skill</td><td>CLO2. Approach and solve problems in Mechanic and Thermodynamics experiments
CLO3. Write scientific report, have understanding the relations between theory and experiment</td></tr>
<tr><td>Attitude</td><td>CLO4. Communicate effectively in writing manner</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: experiment session (4 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Projectile motion</td><td>1</td><td>T,U</td></tr>
<tr><td>Newton’s law of motion</td><td>1</td><td>T,U</td></tr>
<tr><td>Conservation of momentum</td><td>1</td><td>T,U</td></tr>
<tr><td>Conservation of angular momentum</td><td>1</td><td>T,U</td></tr>
<tr><td>Rotational inertia</td><td>1</td><td>T,U</td></tr>
<tr><td>Sliding friction</td><td>1</td><td>T,U</td></tr>
<tr><td>Pendulum</td><td>1</td><td>T,U</td></tr>
<tr><td>Vibrating Strings</td><td>1</td><td>T,U</td></tr>
<tr><td>Gyroscope</td><td>1</td><td>T,U</td></tr>
<tr><td>Bernoulli’s principle</td><td>1</td><td>T,U</td></tr>
<tr><td>Ideal gas law</td><td>1</td><td>T,U</td></tr>
<tr><td>Boyle’s law and Gay-Lussac’s law</td><td>1</td><td>T,U</td></tr>
<tr><td>Heat engine cycles</td><td>1</td><td>T,U</td></tr>
<tr><td>Blackbody radiation</td><td>1</td><td>T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Experiment, write report</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	[1] Lab manual, PASCO Scientific [2] Halliday D., Resnick R. and Walker, J. (2011) *Principles of Physics*, 9th edition, John Willey and Sons, Inc. [3] Alonso M. and Finn E.J. (1992) *Physics,* Addison-Wesley Publishing Company. [4] Faughn/Serway (2006) *Serway's College Physics*, Thomson Brooks/Cole.

3. General Physics 2 (PH021IU)

Module designation	*This subject will provide a basic knowledge of electricity and magnetism.*
Semester(s) in which the module is taught	1, 2, summer semester
Person responsible for the module	Assoc. Prof. Phan Bảo Ngọc Dr. Phan Hiền Vũ Dr. Trần Nguyên Lân Dr. Nguyễn Quang
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the course	Previous course: General Physics 1 (PH019IU) (or Physics 1 (PH013IU) Physics 2 (PH014IU))

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Understand basic knowledge of electricity and magnetism.
CLO2. Apply knowledge of physics to solving problems in science and engineering.</td></tr>
<tr><td>Skill</td><td>CLO3. Apply skills to analyzing and solving problems in science and engineering.</td></tr>
<tr><td>Attitude</td><td>CLO4. Communicate effectively in writing manner.</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Chapter 1: Electric Fields</td><td>3</td><td>I, T, U</td></tr>
<tr><td>Chapter 2: Electric Potential and Capacitance</td><td>2</td><td>I, T, U</td></tr>
<tr><td>Chapter 3: Current and Resistance. Direct Current Circuits</td><td>3</td><td>I, T, U</td></tr>
<tr><td>Chapter 4: Magnetism</td><td>2</td><td>I, T, U</td></tr>
<tr><td>Chapter 5: Electromagnetic Induction</td><td>2</td><td>I, T, U</td></tr>
<tr><td>Chapter 6: Electromagnetic Oscillations and Alternating Current</td><td>2</td><td>I, T, U</td></tr>
<tr><td>Chapter 7: Maxwell’s Equation and Electromagnetic Waves</td><td>1</td><td>I, T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Exam</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	[1] Halliday D., Resnick R. and Walker, J. (2011) *Fundamentals of Physics*, 9th edition, John Willey and Sons, Inc. [2] Alonso M. and Finn E.J. (1992) *Physics,* Addison-Wesley Publishing Company. [3] Hecht, E. (2000) *Physics: Calculus,* 2nd edition, Brooks/Cole. [4] Faughn/Serway (2006) *Serway's College Physics*, Thomson Brooks/Cole.

4. General Physics 2 Lab (PH022IU)

Course designation	*This course provides students with basic knowledge of electricity and magnetism in the laboratory, consisting of: Ohm's law, LRC circuit, RC circuit, LR circuit, magnetic fields of coils….*
Semester(s) in which the course is taught	1, 2, summer semester
Person responsible for the course	MSc. Trịnh Thanh Thủy MSc. Lê Thị Quế
Language	English
Relation to curriculum	Compulsory
Teaching methods	Experiment, writing report
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 55 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 25 Private study including examination preparation, specified in hours: 30
Credit points/ECTS	1 credit/2 ECTS
Required and recommended prerequisites for joining the course	Parallel course: General Physics 2 (PH021IU) (or Physics 3 (PH015IU))

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Understand basic knowledge of electricity and magnetism.</td></tr>
<tr><td>Skill</td><td>CLO2. Approach and solve problems in electricity and magnetism experiments
CLO3. Write scientific report, have understanding the relations between theory and experiment</td></tr>
<tr><td>Attitude</td><td>CLO4. Communicate effectively in writing manner.</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: experiment session (4 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Ohm’s law</td><td>1</td><td>T,U</td></tr>
<tr><td>Resistances in Circuits</td><td>1</td><td>T,U</td></tr>
<tr><td>LRC Circuits</td><td>1</td><td>T,U</td></tr>
<tr><td>Kirchhoff’s laws</td><td>1</td><td>T,U</td></tr>
<tr><td>RC circuit</td><td>1</td><td>T,U</td></tr>
<tr><td>LR circuit</td><td>1</td><td>T,U</td></tr>
<tr><td>Magnetic fields of coils</td><td>1</td><td>T,U</td></tr>
<tr><td>The e/m experiment</td><td>1</td><td>T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Experiment, write report</td></tr>
</table>

Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	[1] Lab manual, PASCO Scientific [2] Halliday D., Resnick R. and Walker, J. (2011) *Principles of Physics*, 9th edition, John Willey and Sons, Inc. [3] Alonso M. and Finn E.J. (1992) *Physics*, Addison-Wesley Publishing Company. [4] Faughn/Serway (2006) *Serway's College Physics*, Thomson Brooks/Cole.

5. General Physics 3 (PH023IU)

Course designation	*This subject will provide a basic knowledge of Wave and Modern Physics*
Semester(s) in which the course is taught	1, 2, summer semester
Person responsible for the course	Dr. Đỗ Xuân Hội Dr. Trần Nguyên Lân
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, assignment.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 85 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 25 Private study including examination preparation, specified in hours: 60
Credit points/ECTS	2 credits/3.08 ECTS
Required and recommended prerequisites for joining the course	Previous course : Physics 1 (PH013IU)

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Understand basic knowledge of waves, quantum physics, special relativity, and nuclear physics
CLO2. Apply knowledge of physics to solving problems in science and engineering</td></tr>
<tr><td>Skill</td><td>CLO3. Apply skills to analyzing and solving problems in science and engineering</td></tr>
<tr><td>Attitude</td><td>CLO4. Communicate effectively in writing manner</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (2 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Chapter 1: Vibration and Mechanical Wave</td><td>3</td><td>I, T,U</td></tr>
<tr><td>Chapter 2: Properties of Light</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Chapter 3: Introduction to Quantum Physics</td><td>3</td><td>I, T,U</td></tr>
<tr><td>Chapter 4: Atomic Physics</td><td>4</td><td>I, T,U</td></tr>
<tr><td>Chapter 5: Relativity and Nuclear Physics</td><td>3</td><td>I, T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Exam</td></tr>
</table>

Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	[1] Lecture Notes [2] Halliday D., Resnick R. and Walker, J. (2011) *Principles of Physics*, 9th edition, John Willey and Sons, Inc. [3] Alonso M. and Finn E.J. (1992) *Physics,* Addison-Wesley Publishing Company. [4] Faughn/Serway (2006) *Serway's College Physics*, Thomson Brooks/Cole.

6. General Physics 3 Lab (PH024IU)

Course designation	*This course provides students with basic knowledge of optics in laboratory, consists of: diffraction, interferences, telescope, brewster's law, photoelectric effect....*
Semester(s) in which the course is taught	1, 2, summer semester
Person responsible for the course	MSc. Lê Thị Quế
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, assignment.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 55 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 25 Private study including examination preparation, specified in hours: 30
Credit points/ECTS	1 credit/2 ECTS
Required and recommended prerequisites for joining the course	Parallel course: General Physics 3 (PH023IU) or Physics 4 (PH012IU)

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Understand basic concepts in Optics and Atomic Physics.</td></tr>
<tr><td>Skill</td><td>CLO2. Approach and solve problems in Optics and Atomic Physics experiments
CLO3. Write scientific report, have understanding the relations between theory and experiment</td></tr>
<tr><td>Attitude</td><td>CLO4. Communicate effectively in writing manner</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: experiment session (4 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Intensity versus Distance</td><td>1</td><td>T,U</td></tr>
<tr><td>Diffraction and Interference of light</td><td>1</td><td>T,U</td></tr>
<tr><td>Polarization of light</td><td>1</td><td>T,U</td></tr>
<tr><td>Telescope</td><td>1</td><td>T,U</td></tr>
<tr><td>Brewster’s Angle</td><td>1</td><td>T,U</td></tr>
<tr><td>Photoelectric effect 1</td><td>1</td><td>T,U</td></tr>
<tr><td>Photoelectric effect 2</td><td>1</td><td>T,U</td></tr>
<tr><td>Atomic Spectra</td><td>1</td><td>T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Experiment, write report</td></tr>
</table>

Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	[1] Lab manual, PASCO Scientific [2] Halliday D., Resnick R. and Walker, J. (2011) *Principles of Physics*, 9th edition, John Willey and Sons, Inc. [3] Alonso M. and Finn E.J. (1992) *Physics,* Addison-Wesley Publishing Company. [4] Faughn/Serway (2006) *Serway's College Physics*, Thomson Brooks/Cole.

7. Calculus 1 (MA001IU)

Course designation	*This course equips students with basic concepts of calculus: limits, continuity, differentiation, and integration. Applications of these concepts are extensively discussed.*
Semester(s) in which the course is taught	1, 2, summer semester
Person responsible for the course	Assoc. Prof. Mai Duc Thanh, Assoc. Prof. Tran Vu Khanh, Dr.Nguyen Minh Quan, Dr. Nguyen Anh Tu, Dr. Ta Quoc Bao.
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lectures, assignments
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 170 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 50 (lectures) Private study including examination preparation, specified in hours: 120
Credit points/ECTS	4 credits/6.16 ECTS
Required and recommended prerequisites for joining the course	None

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Have basic knowledge of limits and derivatives (Program outcomes: a)
CLO2. Have basic knowledge of definite/indefinite integrals
(Program outcomes: a)</td></tr>
<tr><td>Skill</td><td>CLO3. Can compute often used limits, can define and compute derivatives (Program outcomes: a, j)
CLO4. Can compute standard types of integrals. Use integrals in practical situations (Program outcomes: a, j)</td></tr>
<tr><td>Attitude</td><td>CLO5. Confident when dealing with derivatives and integrals. Comfortable with using derivatives and integrals in practical situations. (Program outcome: j, k)</td></tr>
</table></td></tr>
</table>

Content

The description of the contents should clearly indicate the weighting of the content and the level.

Weight: lecture session (4 hours)

Teaching levels: I (Introduce); T (Teach); U (Utilize)

Topic	**Weight**	**Level**
Functions and Graphs, Inverse Functions, Exponential and Logarithmic Functions	1	I, T
Parametric Curves, Limit. One-sided Limits Laws of Limits.	1	I, T
Evaluating Limits. The Squeeze Theorem. Continuity. The Intermediate Value Theorem	1	T, U
Tangent Lines and Velocity Problems. Rates of Change, Derivative.	1	T, U
Higher-Order Derivatives, Rules of Differentiation. Rates of Change in the Natural and Social Sciences	1	T, U
Implicit Differentiation, Differentiation of Inverse Functions,	1	T, U
Logarithmic Differentiation, Linear Approximations. Differentials.	1	T, U
Related Rates, Maxima and Minima. Critical Point, The Mean Value Theorem.	1	T, U
The First and Second Derivative Test, Concavity. Shapes of Curves, Curve Sketching	1	T, U
Indeterminate Forms and l'Hôpital's Rules, Maxima and Minima Problems, Newton's Method	1	T, U
Anti-derivatives and Indefinite Integrals, The Definite Integral	1	I, T
Properties of the Definite Integral. The Fundamental Theorem of Calculus, Integration by Substitution	1	I, T, U
Integration by Parts, Partial Fractions, Numerical Integration,	1	T, U
Improper Integrals, Areas between Curves Areas Enclosed by Parametric Curves	1	T, U
Volumes, Arc Length, Applications to Engineering, Economics and Science	1	T, U

Examination forms	Written examination
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	J. Stewart, *Calculus*, Cengage Learning, 7th edition, 2010.

8. Calculus 2 (MA003IU)

Course designation	*This course is a continuation of Calculus 1. Its aim to equip student with basis concepts of sequence, series, vector functions, functions of several variables, multiple integrals and their applications*
Semester(s) in which the course is taught	1, 2, summer semester
Person responsible for the course	Assoc. Prof. Mai Duc Thanh, Assoc. Prof. Tran Vu Khanh, Dr.Nguyen Minh Quan, Dr. Nguyen Anh Tu, Dr. Ta Quoc Bao.
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lectures, assignments
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 170 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 50 (lectures) Private study including examination preparation, specified in hours: 120
Credit points/ECTS	4 credits/6.16 ECTS
Required and recommended prerequisites for joining the course	Previous course: Calculus 1 (MA001IU)

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Have basic knowledge of series, functions of several variables, multiple integrals (Program outcomes: a)
CLO2. Have basic knowledge of vector calculus (Program outcomes: a)</td></tr>
<tr><td>Skill</td><td>CLO3. Can compute partial derivatives, multiple integral (Program outcomes: a, j)
CLO4. Can show the convergence of a sequence and a series and u, se power series to simplify computation. Can show the optimal problem using partial derivatives, can find the volume of an object in higher dimension by using the multiple integrals (Program outcomes: i, h)</td></tr>
<tr><td>Attitude</td><td>CLO5. Confident when dealing with partial derivatives, multiple integrals. Comfortable with using partial derivatives and multiple integrals in practical situations. (Program outcome: j, k)</td></tr>
</table></td></tr>
</table>

Content

The description of the contents should clearly indicate the weighting of the content and the level.

Weight: lecture session (4 hours)

Teaching levels: I (Introduce); T (Teach); U (Utilize)

Topic	**Weight**	**Level**
Sequences and Convergence	1	I, T
Series	1	I, T
Tests for Convergence	1	T, U
Power series	1	T, U
Representations of Functions as Power series	1	T, U
Taylor and Maclaurin series	1	T, U
Vector Functions and Space Curves, Limit and continuity of vector functions	1	I, T
Derivatives and Integrals of vector functions, Length of space curves	1	T, U
Functions of Several Variables, Limits and Continuity	1	I,T
Partial Derivatives, Tangent Plane and Linear Approximations	1	T, U
Chain Rules, Directional Derivatives and Gradient	1	T, U
Maximum and Minimum Values of Functions of two variables	1	T, U
Lagrange Multipliers and Applications	1	T, U
Double Integrals in Rectangles, Iterated Integrals	1	I, T
Double, Triple Integrals in General regions and Applications	2	T,U

Examination forms	Written examination
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	J. Stewart, *Calculus*, Thomson Learning, 7th edition, 2012.

9. Differential Equations (PH026IU)

Course designation	*This course introduces fundamental mathematical methods and analysis in ordinary differential equations and their applications and a short introduction to partial differential equations.*
Semester(s) in which the course is taught	1, 2, summer semester
Person responsible for the course	Department of Mathematics
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, assignment.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 85 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 25 Private study including examination preparation, specified in hours: 60
Credit points/ECTS	2 credits/3.08 ECTS
Required and recommended prerequisites for joining the course	None

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Solve mathematical problems by using first order, second order, numerical methods, series solutions, Laplace transforms and Fourier series.</td></tr>
<tr><td>Skill</td><td>CLO2. Apply the techniques, skills, and modern engineering tools to engineering practice</td></tr>
<tr><td>Attitude</td><td>CLO3. Confidence when applying differential equations to practical situations.</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (2 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><td>Topic</td><td>Weight</td><td>Level</td></tr>
<tr><td>Chapter 1: Introduction</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Chapter 2: First Order Differential Equations</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Chapter 3: Second Order Linear Equations</td><td>4</td><td>I, T,U</td></tr>
<tr><td>Chapter 4: The Laplace Transform</td><td>3</td><td>I, T,U</td></tr>
<tr><td>Chapter 5: Numerical Methods</td><td>3</td><td>I, T,U</td></tr>
<tr><td>Chapter 6: Partial Differential Equations and Fourier Series</td><td>2</td><td>I, T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Exam</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	[1] Lecture Notes [2] W.E. Boyce, R.C. DiPrima, *Elementary Differential Equations and Boundary Value Problems*, 8th ed., John Wiley & Sons, 2004

10. Probability and statistics for engineers (PH030IU)

Course designation	*This course develops an engineer's view of probability, started from the notion of chance, relative frequencies and then probability. It covers all fundamental concepts in probability, random variables and statistics that will serve everyday an engineer working in practical fields such as quality control, signal processing, biomedical engineering, automatic control, communications etc…*
Semester(s) in which the course is taught	1, 2, summer semester
Person responsible for the course	Department of Mathematics
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the course	Previous course: Calculus 2 (MA003IU)

<table>
<tr><td>Course objectives</td><td>This course will provide students with:
Using data from a variety of sources such as quality control, signal processing, biomedical engineering, automatic control, communications etc
Contemporary computing and database environments, such as R/Python, and being exposed to case studies from outside the classroom.
Skill of formulating a practical problem related to probability and statistics in an analytical form in order to solve it.</td></tr>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Compute probability of simple and complicated events with probability rules; Evaluate probability, mean and variance of random variables and function of random variables
CLO2. Apply the concept of hypothesis testing and apply it to statistical problems.</td></tr>
<tr><td>Skill</td><td>CLO3. Construct a practical problem related to probability and statistics in an analytical form in order to solve it</td></tr>
<tr><td>Attitude</td><td></td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to Probability</td><td>1</td><td>I, T</td></tr>
<tr><td>Axiomatic definition</td><td>2</td><td>T, U</td></tr>
<tr><td>Introduction to random variables (RV)</td><td>3</td><td>T, U</td></tr>
<tr><td>Mean, Variance and Higher Moments of a RV</td><td>2</td><td>T, U</td></tr>
<tr><td>Random vectors</td><td>2</td><td>I, T</td></tr>
<tr><td>Introduction to Computer Simulation of Random Variables</td><td>2</td><td>T, U</td></tr>
<tr><td>Fundamental sampling distributions and data descriptions</td><td>2</td><td>T, U</td></tr>
<tr><td>Estimation Problems</td><td>1</td><td>T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Written examination</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	**Textbook:** [1] Lecture notes **References:** [2] Robert V. Hogg, Elliot A. Tanis and Dale L. Zimmerman, "*Probability and Statistical Inference*", Pearson, 9th Edition, 2015 [3] M. Spiegel et al., "*Theory and problems of probability and Statistics*", Schaum's ouline series, McGraw-Hill Book Company, 3rd Edition, 2009. [4] S. Kay, "*Intuitive Probability and Random Processes Using MATLAB*", Springer, 2006 [5] S. Ross, "*Introduction to Probability models*", Academic Press, 10th Edition, 2010; [6] F.M. Dekking C. Kraaikamp, H.P. Lopuhaa and L.E. Meester "*A Modern Introduction to Probability and Statistics*", Springer, 2005

11. Programming for Engineers (EE057IU)

Course designation	*This course is aimed at students with no or little programming experiences. Generally, it endeavors to provide students with an understanding about the role of programming that can play in solving problems. The course content thus equips the basic terminologies of principles of programming and data structures via C programming language.* *The fundamentals include the history of programming, stepwise refinement and flow-charting, introduction to algorithm analysis; basic data types, type conversion, making decision and looping, branching, I/O operations; functions, recursion; arrays and multiple-subscripted arrays, searching and sorting algorithms; pointers/function pointers; characters and strings; structures, unions, enumerates, operations on bits; introduction to abstract data types; dynamic memory allocation, file processing.*
Semester(s) in which the course is taught	1, 2, summer semester
Person responsible for the course	Dr. Nguyễn Ngọc Trường Minh
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the course	None

<table>
<tr><td>Course objectives</td><td>The course is designed to provide students with complete knowledge of C language. Students will be able to develop logics which will help them to create programs, applications in C. Also, by learning the basic programming constructs they can easily switch over to any other language in future.</td></tr>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course students will be able to:
CLO1: Implement C instructions, data types and programming techniques to solve simple problems
CLO2: Use novel computing technology and translate hypothesis as well as solutions into computer programs
CLO3: Explain the impact of electrical engineering solutions in a global, economic, environmental and social context
CLO4: Use collaboration skill with teammates
CLO5: Implement C into systems
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1, CLO2, CLO3, CLO4, CLO5</td></tr>
<tr><td>Skill</td><td>CLO1, CLO2, CLO3, CLO4, CLO5</td></tr>
<tr><td>Attitude</td><td></td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduction); T (Teaching); U (Utilization)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Programming Fundamentals & Introduction to Computers and C Programming</td><td>1</td><td>I</td></tr>
<tr><td>Algorithm and Flow-Chart</td><td>1</td><td>I</td></tr>
<tr><td>Variables, Data Types and Arithmetic Expressions</td><td>1</td><td>I</td></tr>
<tr><td>Making Decisions, Branching and Looping</td><td>1</td><td>U</td></tr>
<tr><td>I/O Operations in C</td><td>1</td><td>U</td></tr>
<tr><td>Working with C Functions/Recursion</td><td>1</td><td>U</td></tr>
<tr><td>Working with C Pointers/Pointers to Functions</td><td>2</td><td>U</td></tr>
<tr><td>Working with Structures/Unions</td><td>2</td><td>U</td></tr>
<tr><td>Working with C Characters</td><td>1</td><td>U</td></tr>
<tr><td>Operations on Bits</td><td>1</td><td>T</td></tr>
<tr><td>File Processing and Dynamic Memory Allocation</td><td>1</td><td>T</td></tr>
<tr><td>Project</td><td>2</td><td>U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, practical programming exercises</td></tr>
</table>

Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	*[1]* Paul Deitel and Harvey Deitel, "*C How to Program," 8th edition, Pearson, 2016* [2] Brian Kernighan and Dennis Ritchie, "*The C Programming Language,*" 2nd edition, Prentice Hall, 1988 [3] Stephen G. Kochan, "*Programming in C,*" 4th edition, Sams Pub., 2014

12. Programming for Engineers Laboratory (EE058IU)

Course designation	*This laboratory is associated with the Programming for Engineers course. It covers everything that students will need tounderstand the basic concepts covered in the theory course, as well as the implementation of simple-to-complex C programs especially in the field of engineering. Topics include data types, control structures, functions, arrays, files, and the mechanics of running, testing, and debugging.*
Semester(s) in whichthe course is taught	1, 2, summer semester
Person responsiblefor the course	M. Eng, Trang Kiến
Language	English
Relation to curriculu m	Compulsory
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 55 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 25 Private study including examination preparation, specified in hours: 30
Credit points/ECTS	1 credit/2 ECTS
Required and recommended prerequisites for joining the course	Parallel course: Programming for Engineers (EE058IU)
Course objectives	This course conducts sequence of laboratory experiments to present and illustrate implement and debug programs using the C techniques which can investigate some case studies in order to comprehend professional and ethical responsibilities

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course students will be able to:
CLO1: Able to design problem solutions, implement and debug programs using the C techniques.
CLO2: Able to examine some case studies to understand the professional and ethical responsibility.
CLO3: Understand the impact of electrical engineering solutions in a global, economic, environmental and social context.
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1, CLO2, CLO3</td></tr>
<tr><td>Skill</td><td>CLO1, CLO2, CLO3</td></tr>
<tr><td>Attitude</td><td>CLO2, CLO3</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (4 hours)
Teaching levels: I (Introduction); T (Teaching); U (Utilization)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Variables, Data Types, Making Decisions, Branching and Looping</td><td>1</td><td>I, T, U</td></tr>
<tr><td>I/O operations</td><td>1</td><td>I, T, U</td></tr>
<tr><td>Functions/Recursion</td><td>1</td><td>I, T, U</td></tr>
<tr><td>Arrays</td><td>1</td><td>I, T, U</td></tr>
<tr><td>Pointers/Function Pointers</td><td>1</td><td>I, T, U</td></tr>
<tr><td>Structures/Unions/Enumerates</td><td>1</td><td>I, T, U</td></tr>
<tr><td>Characters and Strings, Operations on Bits</td><td>1</td><td>I, T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>short-answer questions</td></tr>
</table>

Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	[1] Laboratory Manual supplied by the instructor

13. Introduction to Computer for Engineers (EE050IU)

<table>
<tr><td>Course designation</td><td>This course is an introduction to solving engineering problems through the use of the computer. It introduces general problem-solving techniques including the concepts of stepwise refinement applied to the development of algorithms. This course will cover elementary programming concepts using the MATLAB programming language and apply those concepts towards the solution of engineering problems.</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>1, 2, summer semester</td></tr>
<tr><td>Person responsible for the course</td><td>School of Electrical Engineering</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, assignment.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>(Estimated) Total workload: 127.5
Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5
Private study including examination preparation, specified in hours: 90</td></tr>
<tr><td>Credit points/ECTS</td><td>3 credits/4.62 ECTS</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>None</td></tr>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Understand MATLAB instructions, data type and programming techniques</td></tr>
</table></td></tr>
</table>

	Skill	CLO2. Apply MATLAB language to implement, debug and validate the correctness of an algorithm
	Attitude	CLO3. Understand the impact of electrical engineering solutions in a global, economic, environmental and social context

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduction); T (Teaching); U (Utilization)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to computing and engineering & Basic function of MATLAB</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Matrices and Vectors</td><td>1</td><td>I, T,U</td></tr>
<tr><td>File and cell arrays Mathematical operation with arrays</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Plot and graphs Script and function</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Logical operators and conditional statements</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Loop and strings</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Graphical User Interface (GUI) & Image Processing</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Numerical Integration</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Numerical Interpolation</td><td>1</td><td></td></tr>
<tr><td>Curve fitting</td><td>2</td><td></td></tr>
<tr><td>ODE</td><td>3</td><td></td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Exam</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	**Textbook:** [1] Stephen J. Chapman, *MATLAB Programming for Engineers*, Thompson Books. *Software:* Mathworld (2014/2014). MATLAB

14. Mathematics for Engineers (PH025IU)

Course designation	*This course develops a synthetic view of mathematical knowledge and skills in analyzing and modeling Signals and Systems. Covers review of fundamental harmonic analysis, with applications in Electronics, Control, Communications and Signal processing.*
Semester(s) in which the course is taught	1, 2, summer semester
Person responsible for the course	Dr. Trần Nguyên Lân
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, assignment.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 170 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 50 Private study including examination preparation, specified in hours: 120
Credit points/ECTS	4 credits/6.16 ECTS
Required and recommended prerequisites for joining the course	Previous course: Calculus 2 (MA003IU)

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course students will be able to:<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Show the understanding of complex analysis, determinants, and matrices.</td></tr>
<tr><td>Skill</td><td>CLO2. Apply skills to solve problems in science and engineering.</td></tr>
<tr><td>Attitude</td><td>CLO3. Recognize the need for further self-learning in mathematics.</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduction); T (Teaching); U (Utilization)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Part I Complex analysis
Functions of a complex variable: limits and continuity</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Singular points, Poles. Laurent series. Line integrals. Cauchy’s integral theorem.</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Residues. Residue theorem. Evaluation of definite integrals</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Application of the residue theorem to compute the Fourier and Laplace transform</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Part II Determinants and matrices
Introduction to determinants</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Matrices: definition; special type of matrices; addition, multiplication; transposition, inversion</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Systems of linear equations; existence of solution; unicity condition; Gauss-Jordan elimination; homogeneous linear systems</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Eigenvalues and eigenvectors of a matrix</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Applications of Eigen technique to solve linear problems.</td><td>1</td><td>I, T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Exam</td></tr>
</table>

Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	[1] Lecture Notes [2] K.T. Tang, *Mathematical Methods for Engineers and Scientists 1*", Springer Verlag, 2007.

15. Engineering Ethics and Professional Skills (PE020IU)

Module designation	*This course is designed to introduce engineering students to the concepts, theory and practice of engineering ethics. It will allow students to explore the relationship between ethics and engineering and apply classical moral theory and decision making for engineering issues encountered in academic and professional careers. This course also provides students with the professional skills: sharing ideas and concepts, team working, and presentation skills.*
Semester(s) in which the module is taught	1, 2, summer semester
Person responsible for the module	Dr. Nguyễn Hoài Nghĩa, Dr. Huỳnh Võ Trung Dũng
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, presentation, and assignments.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the module	None
Course learning outcomes	Overall objectives are to equip IU students with knowledge about the philosophies of ethics, professional practice, and world culture. Students who complete the course will be able to perform the following tasks: ● Having knowledge of the definition of engineering ethics, codes of ethics, ethic philosophies, intellectual property, copyright, and fair use of copyrighted materials and

<table>
<tr><td></td><td>research data.
• Using different problem-solving techniques to solve ethical dilemmas.
• Analyzing social, environmental, legal aspects, safety and sustainability issues of engineering activities.</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to engineering professionalism and ethics</td><td>1</td><td>I</td></tr>
<tr><td>Engineers in Society</td><td>1</td><td>T, U</td></tr>
<tr><td>Moral choices and codes of ethics</td><td>1</td><td>T, U</td></tr>
<tr><td>Philosophical ethics</td><td>2</td><td>I, T, U</td></tr>
<tr><td>Ethical problem-solving techniques</td><td>1</td><td>T, U</td></tr>
<tr><td>Engineers at the Workplaces - Leadership</td><td>2</td><td>T, U</td></tr>
<tr><td>Truth in actions and words
Academic and Research Ethics</td><td>1</td><td>T</td></tr>
<tr><td>Commitment to Safety</td><td>1</td><td>T, U</td></tr>
<tr><td>Internet ethics, Privacy Issues and Intellectual Property Rights</td><td>1</td><td>T, U</td></tr>
<tr><td>Environmental ethics
Sustainable engineering</td><td>1</td><td>T</td></tr>
<tr><td>Review</td><td>1</td><td>T</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Constructed-response test</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed based on their class participation. Questions and comments are</td></tr>
</table>

	strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this module.
Reading list	**Textbook**: [1] M. W. Martin and R. Schinzinger (2010). *Introduction to engineering ethics* McGraw-Hill Education 2nd edition [2] C. B. Fleddermann. (2011). *Engineering Ethics,* Pearson 4th edition

POLITICAL, ECONOMIC, CULTURAL AND SOCIAL KNOWLEDGE

16. Marxist-Leninist philosophy (PE015IU)

Course title	Marxist-Leninist philosophy *(Triết học Mac-Lenin)*
Module designation	*The course equips students with basic knowledge of Marxist-Leninist philosophy.*
Semester(s) in which the module is taught	1, 2, summer semester
Person responsible for the module	Lecturers at School of Political and Administration Sciences, VNU-HCM
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, group discussion, presentation
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/ 4.62 ECTS
Required and recommended prerequisites for joining the module	None
Module objectives	- The course equips students with the basic contents of the worldview and the Marxist-Leninist philosophical methodology. - Help students to apply knowledge about worldview, Marxist-Leninist philosophical methodology creatively in cognitive and practical activities, in order to solve problems of social life of country and time.

Tentative learning outcomes	I. Knowledge 1. Philosophy and its role in social life 1.1. Conceptualize philosophy and some basic concepts 1.2. Recognize the opposition between materialism and idealism in solving the fundamental problem of philosophy 1.3. Understanding dialectical materialism - the highest developed form of it 1.4. Understand the birth, objects, functions and roles of Marxist-Leninist philosophy 2. Dialectical materialism 2.1. Understanding matter from the point of view of dialectical materialism 2.2. Understanding consciousness from the point of view of dialectical materialism 2.3. Resolving the relationship between matter and consciousness from the point of view of dialectical materialism 2.4. Understand dialectics and materialistic dialectics 2.5. Understand the two basic principles of materialist dialectic and derive the methodological significance of each 2.6. Understand the pairs of basic categories of the material dialectic and derive the methodological meaning of each pair of categories 2.7. Understand the fundamental rules of the materialist dialectic and derive the methodological meaning of each one 2.8. Understand practice, perception, the role of practice in perception and truth 3. Historical materialism 3.1. Understand the role of production and its methods in the existence and development of society 3.2. Understand the dialectical relationship between forces of production and relations of production 3.3. Understand the dialectical relationship between infrastructure and market economy; the natural development of socio-economic forms 3.4. Understand class, class struggle; ethnicity and the relationship among class, nation and humanity 3.5. Understanding the state and social networks 3.6. Understand the dialectical relationship between social existence and social consciousness 3.7. Understand the nature of human being; the phenomenon of alienation and liberation of man from the relationship between the individual and society, and from the role of the masses.

<table>
<tr><td></td><td>II. Skills
Demonstrate the ability to generalize, think, debate, critique, and groupwork
1. Have the skill of generalizing to pick out keywords for each content and think systematically
2. Have skills in presenting, explaining, criticizing, debating and eloquent about theories being studied and researched based on practice
3. Have skills in social communication, cooperation and teamwork, sharing knowledge and experience, ability to run a group
III. Attitudes
Express consciousness and awareness during and after learning
1. Have a sense of responsibility to protect the science, revolution and humanity of Marxism-Leninism
2. Have a sense of personal responsibility towards the community
3. Have awareness of the need for lifelong learning and research and applying practically.</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: period (1 period = 50 minutes)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction</td><td>1</td><td>I, T</td></tr>
<tr><td>Philosophy and its role in social life</td><td>15</td><td>T, U</td></tr>
<tr><td>Dialectical materialism</td><td>15</td><td>T, U</td></tr>
<tr><td>Historical materialism</td><td>14</td><td>T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Class discussion; Group presentations and reports; Mid-term exam: essay (opened-book); Final exam: essay (closed-book)</td></tr>
<tr><td>Study and examination regulations</td><td>1. Regulations for group presentations
- Forming a group: 5 students/group. The deadline for group topic registration on the forum is session 2 or directly submit it to the lecturer at the exam.
- Week 4 (4th session) begin to present in order. Note that the presenting groups need to fully show up and bring along all relevant documents.
- Submission form: submit files and minutes of group work via email to the lecturer
2. Regulations on time, attendance and discipline in the course: attend class on time and at least 80% of the sessions (only to</td></tr>
</table>

	be absent for a maximum of 20%). Exam ban is applied to those who miss more than the regulated number of sessions. Students must have all test scores, lively discussions, constructive and serious statements in class.
Materials	1. Ministry of Education and Training (2019), *Giáo trình Triết học Mác - Lênin,* National Political Publishing House, Hanoi. 2. Ministry of Education and Training (2012), *Giáo trình Những Nguyên lý cơ bản của chủ nghĩa Mác - Lênin,* National Political Publishing House, Hanoi. 3. Governing Body (2008), *Giáo trình Triết học Mác-Lênin,* National Political Publishing House, Hanoi.

17. Marxist – Leninist Political Economy (PE016IU)

Course title	Marxist-Leninist political economy *(Kinh tế chính trị Mac-Lenin)*
Module designation	*The program consists of 6 chapters, in which Chapter 1 discusses the Objects, research methods and functions of Marxist-Leninist political economy; the remain chapters present the core content of Marxist-Leninist Political Economy according to the module's objectives. Specifically, the content includes commodities, markets and the role of stakeholders; producing surplus value; competition and monopoly; socialist-oriented market economy and economic interest relations in Vietnam; and industrialization, modernization, and international economic integration in Vietnam.*
Semester(s) in which the module is taught	1, 2, summer semester
Lecturer	Lecturers at School of Political and Administration Sciences, VNU-HCM
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, group discussion, presentation
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 85 Contact hours (lecture, exercise): 25 Private study including examination preparation, specified in hours: 60
Credit points/ECTS	2 credits/ 3.08 ECTS
Required and recommended prerequisites for joining the module	Parallel course: Marxist-Leninist philosophy (PE015IU)

Module objectives	Firstly, to equip students with fundamental knowledge of Marxist-Leninist political economy in the context of economic development of the country and the world today; to ensure the basic, systematic, scientific, and up-to-date knowledge associated with practice, creativity, skills, thinking, and traits of students, as well as to enhance the interdisciplinary and non-overlapping interoperability, also reduce the amount of academic or outdated material for college and university non-theoretical students. Secondly, on that basis, to form the mindset, skills of analysis, evaluation, and identification of the nature of economic benefit relations in the country's socio-economic development, contributing to helping students build appropriate social responsibility in the job position and life after graduation. Thirdly, to contribute to building the stance and ideology of Marxism-Leninism towards students.
Tentative learning outcomes	I. Knowledge *1. Objects, research methods and functions of Marxist-Leninist political economy* 1.1. Understanding the formation and development of Marxist-Leninist political economy 1.2. Identify the research object of Marxist-Leninist political economy 1.3. Understand the research method of Marxist-Leninist political economy 1.4. Understand the functions of Marxist-Leninist political economy course *2. Commodities, markets, and the role of stakeholders* 2.1. Understand the definition and the conditions for the production of goods 2.2. Understanding the commodity, its two attributes, and the relationship between them 2.3. Understand the relationship between the duality of commodity-producing labor and the two attributes of commodities 2.4. Understand the quality and quantity of the good's value and the affecting factors 2.5. Understand the origin, nature and function of money 2.6. Understanding the market, the role of the market, the market mechanism and the market economy 2.7. Understand some key patterns of the market economy 2.8. Understand the role of stakeholders *3. Surplus value in a market economy* 3.1. Understand the concept, the general formula and contradiction of capital

	3.2. Understand what the commodity labor is and why need to study it 3.3. Understand what surplus value is 3.4. Understanding the nature of capital accumulation 3.5. Understand the concepts: production cost, profit, profit margin, average profit, commercial profit, factors affecting profit rate 3.6. Understand what income is 3.7. Understanding capitalist rents, their types and land prices *4. Competition and monopoly in the market economy* 4.1. Understand the relationship between competition and monopoly in a market economy 4.2. Understand the causes of monopoly formation in the market economy 4.3. Understanding the basic economic features of monopoly in capitalism from Lenin's viewpoint 4.4. Understand the causes of formation and development of state monopoly capitalism 4.5. Understand the nature and the main manifestations of state monopoly in capitalism 4.6. Understand the historical role of capitalism *5. Socialist-oriented market economy and economic interest relations in Vietnam* 5.1. Understand the concept of a socialist-oriented market economy in Vietnam 5.2. Understand the objective necessity of developing a socialist-oriented market economy in Vietnam 5.3. Understanding the characteristics of the socialist-oriented market economy in Vietnam 5.4. Understand what the socialist-oriented market economy institution is and the need to improve it 5.5. Grasp the basic contents of improving the socialist-oriented market economy institution in Vietnam 5.6. Understand the concept and the relationship of economic benefits 5.7. Understand the role of the state in ensuring the harmonization of relations of interest *6. Vietnam's industrialization, modernization and international economic integration* 6.1. Understand what the industrial revolution is and be able to generalize the historical revolutions 6.2. Understand the role of the industrial revolution for development 6.3. Understand the concept and typical models of industrialization in the world 6.4. Understand the objective necessity of industrialization and

	modernization in Vietnam 6.5. Understand the contents of industrialization and modernization in Vietnam 6.6. Understand industrialization and modernization in Vietnam in the context of the 4.0 industrial revolution. 6.7. Understand the concept and the reason why international economic integration an objective necessity 6.8. Understand the contents and positive and negative impacts of international economic integration 6.9. Grasp the direction of improving the efficiency of international economic integration in Vietnam's development II. Skills *Demonstrate the ability to generalize, think, debate, critique, and groupwork* 1. Have the skill of generalizing to pick out keywords for each content and think systematically 2. Have skills in presenting, explaining, criticizing, debating and eloquent about theories being studied and researched based on practice 3. Have skills in social communication, cooperation and teamwork, sharing knowledge and experience, ability to run a group III. Attitudes *Express consciousness and awareness during and after learning* 1. Have a sense of responsibility to protect the science, revolution and humanity of Marxism-Leninism 2. Have a sense of personal responsibility towards the community 3. Have awareness of the need for lifelong learning and research and applying practically.

<table>
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<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction</td><td>1</td><td>I</td></tr>
<tr><td>Objects, research methods and functions of Marxist-Leninist political economy</td><td>2</td><td>I, T</td></tr>
<tr><td>Commodities, markets, and the role of stakeholders</td><td>6</td><td>T</td></tr>
<tr><td>Surplus value in a market economy</td><td>6</td><td>T, U</td></tr>
<tr><td>Socialist-oriented market economy and economic interest relations in Vietnam</td><td>5</td><td>T, U</td></tr>
<tr><td>Vietnam's industrialization, modernization, and international economic integration</td><td>5</td><td>T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Class discussion; Group presentations and reports; Mid-term exam: essay (opened-book); Final exam: essay (closed-book)</td></tr>
<tr><td>Study and examination regulations</td><td>1. Regulations for group presentations
- Forming a group: 5 students/group. The deadline for group topic registration on the forum is session 2 or directly submit it to the lecturer at the exam.
- Week 4 (4th session) begin to present in order. Note that the presenting groups need to fully show up and bring along all relevant documents.
- Submission form: submit files and minutes of group work via email to the lecturer
2. Regulations on time, attendance, and discipline in the course: attend class on time and at least 80% of the sessions (only to be absent for a maximum of 20%). Exam ban is applied to those who miss more than the regulated number of sessions. Students must have all test scores, lively discussions, constructive and serious statements in class.</td></tr>
</table>

Materials	1. Mandatory document: Marxist-Leninist political economy textbook for non-specialized undergraduates. 2. Referential materials: a) Robert, J.R. & Robert, F. H. (2003), *History of economic theory and method (in Vietnamese)*, Statistical Publishing House. b) Politic Economy Institute, Ho Chi Minh National Academy of Politics (2018), *Giáo trình Kinh tế chính trị Mác - Lê nin*, Political Theory House. c) K. Marx and F.Engels, Full Volume (vol. 20, 23, 25), National Political Publishing House, 1994. d) V.I. Lenin, Full Volume, Progress Press, Moscow, 1976. e) Davig Begg, Stanley Fisher, Rudiger Dornbusch, *Kinh tế học*, Hanoi Education Publishing House, 1992. f) Communist Party of Vietnam (2016), Document of the 12th National People's Congress, National Political Publishing House, Hanoi. g) Communist Party of Vietnam (2016), Report summarizing some theoretical and practical problems through thirty years of renovation (1986 - 2016), National Political Publishing House, Hanoi. h) Communist Party of Vietnam (2017), Resolution No. 11-NQ/TW dated June 3, 2017 on: "Improving the socialist-oriented market economy institution" i) Directive No. 16/CT-TTg (2017) "on strengthening access to the 4.0 industrial revolution". j) Jeremy Rifkin (2014), *The third industrial revolution (in Vietnamese)*, Labor and Social Publisher Co. Ltd. k) Manfred B. Steger (2011), *Globalization - A Very Short Introduction*, Knowledge Publishing House. l) Klaus Schwab (2015), *The fourth industrial revolution*, National Political Publishing House, 2018.

18. Scientific socialism (PE017IU)

Course title	SCIENTIFIC SOCIALISM *(Chủ nghĩa Xã hội Khoa học)*
Module designation	*The course equips students with basic knowledge of scientific socialism.*
Semester(s) in which the module is taught	1, 2, summer semester
Person responsible for the module	Lecturers at School of Political and Administration Sciences, VNU-HCM
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, group discussion, presentation
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 85 Contact hours (lecture, exercise): 25 Private study including examination preparation, specified in hours: 60
Credit points/ECTS	2 credits/ 3.08 ECTS
Required and recommended prerequisites for joining the module	Previous courses l. Marxist-Leninist political economy (PE016IU) 2. Marxist-Leninist philosophy (PE015IU)
Module objectives	- The subject equips students with the basic contents of scientific socialism (one of the three constituent parts of Marxism-Leninism). - Help students to apply knowledge about scientific socialism creatively in cognitive and practical activities, in order to solve problems of social life of country and time.

Tentative learning outcomes	I. Knowledge *1. Introduction to Scientific Socialism* 1.1. Generalize the birth of Scientific Socialism, the historical background and the role of Karl Marx and Friedrich Engels 1.2. Recognize the basic development stages of Scientific Socialism shown in the works 1.3. Understand the object, method and significance of the study of Scientific Socialism *2. The historical mission of the working class* 2.1. Understand the concept of the working class and its characteristics 2.2. Understand the content and characteristics of the historical mission of the working class 2.3. Explain the conditions that determine the historical mission of the working class 2.4. Analyze the similarities and differences of the working class and the implementation of the mission of the them in the world today 2.5. Understand the basic characteristics of the Vietnamese working class and the content of the historical mission of them today 2.6. Present the direction and some key solutions to build the working class in Vietnam today *3. Socialism and the transition to socialism* 3.1. Understanding Socialism is the first stage of the socialist-economic form of communism 3.2. Describe the basic features of socialism 3.3. Explain the objective necessity of the transition to socialism and the basic features of it 3.4. Understand the characteristics of the transition period and socialism in Vietnam, present the directions to build socialism in Vietnam today *4. Democracy and the socialist state* 4.1. Explain the concept of democracy and the birth and development of democracy in the history of human society 4.2. Understand the birth process and nature of socialist democracy 4.3. Understand the birth, nature and function of the socialist state as well as the relationship between democracy and the state 4.4. Understand the birth, development and nature of socialist democracy in Vietnam 4.5. Present the basic characteristics and solutions to build a legal socialist state in Vietnam today *5. Social structure - classes and alliances of classes and classes in the transition to socialism* 5.1. Present the concept of social structure - generalization and the change of class social structure during the transition to socialism

	5.2. Explain the inevitability of class alliances during the transition to socialism 5.3. Understand the social-class structure in Vietnam during the transitional period and present basic solutions to build and develop class alliances and social classes in Vietnam *6. Ethnic and religious issues in the transition to socialism* 6.1. Understand the basic concepts and characteristics of the nation and the Marxist-Leninist point of view on the national issue 6.2. Present the basic characteristics of the nation in Vietnam and the viewpoints on ethnic policies of the Party and State of Vietnam. 6.3. Understanding the nature, origin, features of religion and basic principles of solving religious problems in the transition to socialism 6.4. Explain the characteristics of religion in Vietnam and the policies of the Party and State of Vietnam towards religious beliefs today 6.5. Understand the characteristics of ethnic and religious relations in Vietnam and present basic orientations to solve the relationship between ethnicity and religion in Vietnam today *7. Family problems in the transition to socialism* 7.1. Outline the position, function and role of the family in society 7.2. Identify the bases for building a family during the transition to socialism 7.3. Explain the change of the Vietnamese family and present the basic directions for building and developing the Vietnamese family during the transition to socialism II. Skills *Demonstrate the ability to generalize, think, debate, critique, and groupwork* 1. Have the skill of generalizing to pick out keywords for each content and think systematically 2. Have skills in presenting, explaining, criticizing, debating and eloquent about theories being studied and researched based on practice 3. Have skills in social communication, cooperation and teamwork, sharing knowledge and experience, ability to run a group III. Attitudes *Express consciousness and awareness during and after learning* 1. Have a sense of responsibility to protect the scientific and revolutionary nature of Marxist-Leninist theories on socialism and the transition to socialism in Vietnam 2. Have a sense of personal responsibility towards the community 3. Have awareness of the need for lifelong learning and research and applying practically

<table>
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<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction</td><td>1</td><td>I, T</td></tr>
<tr><td>Introduction to Scientific Socialism</td><td>4</td><td>I, T</td></tr>
<tr><td>The historical mission of the working class</td><td>4</td><td>T</td></tr>
<tr><td>Socialism and the transition to socialism</td><td>4</td><td>I, T</td></tr>
<tr><td>Democracy and the socialist state</td><td>4</td><td>T, U</td></tr>
<tr><td>Social structure - classes and alliances of classes and classes in the transition to socialism</td><td>4</td><td>I, T</td></tr>
<tr><td>Ethnic and religious issues in the transition to socialism</td><td>4</td><td>T, U</td></tr>
<tr><td>Family problems in the transition to socialism</td><td>5</td><td>T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Class discussion; Group presentations and reports; Practices; Mid-term exam; Final exam</td></tr>
<tr><td>Study and examination regulations</td><td>1. Regulations for group presentations
- Forming a group: 5 students/group. The deadline for group topic registration on the forum is session 2 or directly submit it to the lecturer at the exam.
- Week 4 (4th session) begin to present in order. Note that the presenting groups need to fully show up and bring along all relevant documents.
- Submission form: submit files and minutes of group work via email to the lecturer
2. Regulations on time, attendance, and discipline in the course: attend class on time and at least 80% of the sessions (only to be absent for a maximum of 20%). An exam ban is applied to those who miss more than the regulated number of sessions. Students must have all test scores, lively discussions, constructive and serious statements in class.</td></tr>
<tr><td>Materials</td><td>1. Ministry of Education and Training. (2019). Giáo trình Chủ nghĩa xã hội khoa học, National Political Publishing House, Hanoi.
2. Ministry of Education and Training. (2012). Giáo trình Những</td></tr>
</table>

	Nguyên lý cơ bản của chủ nghĩa Mác - Lênin, National Political Publishing House, Hanoi. 3. Governing Body. (2008). *Giáo trình Chủ nghĩa xã hội khoa học,* National Political Publishing House, Hanoi.

19. History of Vietnamese communist party (PE018IU)

Course title	HISTORY OF VIETNAMESE COMMUNIST PARTY (*Lịch sử Đảng Cộng sản Việt Nam*)
Module designation	*The course equips students with basic knowledge about the History of the Communist Party of Vietnam*
Semester(s) in which the module is taught	1, 2, summer semester
Person responsible for the module	Lecturers at School of Political and Administration Sciences, VNU-HCM
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, group discussion, presentation
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 85 Contact hours (lecture, exercise): 25 Private study including examination preparation, specified in hours: 60
Credit points/ECTS	2 credits/ 3.08 ECTS
Required and recommended prerequisites for joining the module	Previous course 1. Marxist-Leninist philosophy (PE015IU) 2. Marxist-Leninist political economy (PE016IU) 3. Scientific socialism (PE017IU)
Module objectives	1. Knowledge: providing systematic and basic knowledge about the birth of the Communist Party of Vietnam (1920-1930), the Party's leadership over the Vietnamese revolution during the struggle for power (1930-1945), the two resistance wars against French and US colonialism (1945-1975), and national construction and defense during the period of the country's transition to socialism and carrying out the renovation work (1975-2018).

	2. Ideology: Through historical events and experiences to build a sense of respect for objective truths, raise pride and confidence in the Party's leadership. 3. Skills: Equip with scientific thinking methods on history, skills in choosing research materials and studying subjects; and the ability to apply historical awareness to practical work and critical thinking toward false claims about the history of the Party.
Tentative learning outcomes	I. Knowledge 1. Objects, functions, tasks, contents and methods of research and study History of the Communist Party of Vietnam Understand the objects, purposes of study and research and some basic requirements on learning and research methods 2. The Communist Party of Vietnam was born and led the struggle for power (1930-1945) 2.1. Understanding the historical context that influenced the birth of the Communist Party of Vietnam 2.2. Understand the process of preparing the conditions for the establishment of the Party of Nguyen Ai Quoc 2.3. Understand the contents of the Party's founding conference and the Party's first political platform 2.4. Understand the historical significance of the establishment of the Communist Party of Vietnam 2.5. Understanding the revolutionary movements of 1930-1935 and the policies of restoring the movement in 1932-1935 2.6. Understanding the democracy movement in 1936-1939 2.7. Understanding the national liberation movement in 1939-1945 2.8. Understanding the nature, meaning and experience of the August Revolution in 1945 3. The Party led two resistance wars, completed the national liberation and reunification (1945-1975) 3.1. Understand the policy of building and defending the revolutionary government in 1945-1946 3.2. Understand the line of national resistance against the French colonialists and the process of organizing its implementation from 1946 to1950 3.3. Understand the policy of promoting the resistance against the French colonialists and the implementation process from 1946 to 1950 3.4. Understand the historical significance and experience of the Party in leading the resistance war against French colonialism and US intervention 3.5. Understanding the Party's process of leading the two regions'

	revolutions in the 1954-1965 period 3.6. Mastering the Party's revolutionary leadership in the 1965-1975 period 3.7. Understand the meaning and experience of the Party's leadership in the resistance war against the US in 1954-1975 4. The Party led the country in the transition to socialism and carried out the Doi moi (1975-2018) 4.1. Understand the policy of building socialism and defending the Fatherland 1975-1981 4.2. Understanding the contents of the 5th National Congress of the Party and the breakthroughs to continue economic renovation 1982-1986 4.3. Understanding the Party's point of view of comprehensive renovation, bringing the country out of the 1986-1996 socio-economic crisis 4.4. Understand the achievements and experiences of the innovation process 4.5. Understand the great victories of the Vietnamese revolution under the leadership of the Party 4.6. Understanding the great lessons of the Party's leadership from 1930 to 2018 II. Skills Demonstrate the ability to generalize, think, debate, critique, and groupwork 1. Exercise independent thinking capacity in researching the Party's revolutionary lines, strategies and tactics 2. Have critical thinking, analytical, synthesis and evaluation skills related to the subject; and from there, apply the learned knowledge to actively and actively perceive political, economic, cultural and social issues according to the guidelines, policies and laws of the Party and State. 3. Have writing skills, individual working skills, teamwork skills, and presenting research results

	II. Skills Demonstrate the ability to generalize, think, debate, critique, and groupwork 1. Exercise independent thinking capacity in researching the Party's revolutionary lines, strategies and tactics 2. Have critical thinking, analytical, synthesis and evaluation skills related to the subject; and from there, apply the learned knowledge to actively and actively perceive political, economic, cultural and social issues according to the guidelines, policies and laws of the Party and State. 3. Have writing skills, individual working skills, teamwork skills, and presenting research results III. Attitudes Express consciousness and awareness during and after learning 1. Believe in the Party's leadership for the Vietnamese revolution 2. Determine to strive for the implementation of the Party's revolutionary line 3. Have a serious attitude in learning, scientific research, awareness of life and society, self-training to become a person of solid political quality, bravery, ethics, and good level of expertise; form affection and belief in the revolutionary path that our nation has chosen The description of the contents should clearly indicate the weighting of the content and the level. Weight: period (1 period = 50 minutes) Teaching levels: I (Introduce); T (Teach); U (Utilize)

	<table><tr><th>Topic</th><th>Weight</th><th>Level</th></tr><tr><td>Introduction</td><td>1</td><td>I, T</td></tr><tr><td>Objects, functions, tasks, contents and methods of research and study History of the Communist Party of Vietnam</td><td>4</td><td>I, T</td></tr><tr><td>The Communist Party of Vietnam was born and led the struggle for power (1930-1945)</td><td>5</td><td>T</td></tr><tr><td>The Party led two resistance wars, completed the national liberation and reunification (1945-1975)</td><td>5</td><td>I, T</td></tr><tr><td>The Party led the country in the transition to socialism and carried out the Doi moi (1975-2018)</td><td>5</td><td>T, U</td></tr></table>
Examination forms	Class discussion; Group presentations and reports; Mid-term exam; Final exam
Study and examination regulations	1. Regulations for group presentations - Forming a group: 5 students/group. The deadline for group topic registration on the forum is session 2 or directly submit it to the lecturer at the exam. - Week 4 (4th session) begin to present in order. Note that the presenting groups need to fully show up and bring along all relevant documents. - Submission form: submit files and minutes of group work via email to the lecturer 2. Regulations on time, attendance and discipline in the course: attend class on time and at least 80% of the sessions (only to be absent for a maximum of 20%). Exam ban is applied to those who miss more than the regulated number of sessions. Students must have all test scores, lively discussions, constructive and serious statements in class.
Materials	1. Ministry of Education and Training. (2019). Chương trình môn học Lịch sử Đảng Cộng sản Việt Nam. 2. Governing Body directed the compilation of national textbooks of Marxist-Leninist sciences, Ho Chi Minh's Thoughts. (2018). Giáo trình Lịch sử Đảng Cộng sản Việt Nam (revised and supplemented edition). National Political Publishing House, Hanoi.

20. Ho Chi Minh's Thoughts (PE019IU)

Course title	HO CHI MINH'S THOUGHTS *(Tư tưởng Hồ Chí Minh)*
Module designation	*The course equips students with basic knowledge about subjects, research methods and meaning of Ho Chi Minh's ideologies; origin of Ho Chi Minh's ideologies; national independence and socialism; Communist Party of Viet Nam and the Vietnamese State; great national unity and international solidarity; culture, morality and human.*
Semester(s) in which the module is taught	1, 2, summer semester
Person responsible for the module	Lecturers at School of Political and Administration Sciences, VNU-HCM
Language	Vietnamese
Relation to curriculum	Compulsory
Teaching methods	Lecture, group discussion, presentation
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 85 Contact hours (lecture, exercise): 25 Private study including examination preparation, specified in hours: 60
Credit points/ECTS	2 credits/ 3.08 ECTS
Required and recommended prerequisites for joining the module	Previous course 1. Marxist-Leninist philosophy (PE015IU) 2. Marxist-Leninist political economy (PE016IU) 3. Scientific socialism (PE017IU) 4. History of Vietnamese Communist Party PH018IU
Module objectives	Knowledge: Equip students with basic knowledge about the concept, origin, process of formation and development of Ho Chi Minh's thoughts; the basic contents of Ho Chi Minh's thoughts; the application of the Communist Party of Vietnam in the national-democratic and socialist revolution in the current national renewal process.

	Skills: Form the skills of independent thinking, analyzing, evaluating and applying Ho Chi Minh's thought creatively to solve problems in life, study and work. Attitudes: Help students improve their political bravery, patriotism, loyalty to the goals and ideals of national independence associated with socialism; aware of the role and value of Ho Chi Minh's thoughts for the Vietnamese Party and nation; aware their responsibility in studying and training to contribute to the construction and defense of the Fatherland.
Tentative learning outcomes	I. Knowledge *1. Concept, subject, research methodology and meaning of Ho Chi Minh ideology module* 1.1. Understand the concept of Ho Chi Minh's thoughts 1.2. Understand the research object 1.3. Grasp some basic requirements on learning and research methods of Ho Chi Minh's ideology 1.4. Understand the meaning of learning ideological course *2. The foundation, formation and development of Ho Chi Minh ideology* 2.1. Understand the practical basis, theoretical premise and subjective factors forming Ho Chi Minh's thoughts 2.2. Understand the process of formation and development of Ho Chi Minh's thoughts 2.3. Grasp the value of Ho Chi Minh's thoughts for the Vietnamese revolution and the progressive development of mankind *3. Ho Chi Minh ideology on national independence and socialism* 3.1. Aware of the scientific, revolutionary and creative nature of Ho Chi Minh's thoughts on national independence and liberation revolution 3.2. Grasp Ho Chi Minh's view on the necessity of socialism, building socialism and the transition period to socialism in Vietnam 3.3. Understand Ho Chi Minh's view on the relationship between national independence and socialism 3.4. Apply Ho Chi Minh's thoughts on national independence associated with socialism in the current revolution

	4. Ho Chi Minh ideology on the Communist Party of Vietnam of the people, by the people and for the people 4.1. Understand the basic contents of Ho Chi Minh's thoughts on the Communist Party of Vietnam 4.2. Understand the basic contents of Ho Chi Minh's thoughts on the state of the people, by the people, for the people 4.3. Apply Ho Chi Minh's thoughts to the construction of the Party and the State *5. Ho Chi Minh ideology on national great unity and international solidarity* 5.1. Understand the basic views of Ho Chi Minh's thoughts on great national unity 5.2. Understand the basic views of Ho Chi Minh's thoughts on international solidarity 5.3. Apply Ho Chi Minh's thoughts on great national unity and international solidarity in the current period *6. Ho Chi Minh ideology on culture, morality and human* 6.1. Grasp basic knowledge of Ho Chi Minh's thoughts on culture 6.2. Grasp basic knowledge of Ho Chi Minh's thoughts on new morality (revolutionary morality) 6.3. Grasp the basic knowledge of Ho Chi Minh's thoughts on culture 6.4. Apply Ho Chi Minh's thoughts on culture, morality and people in building the current Vietnamese culture, morality and human II. Skills Demonstrate the ability to generalize, think, debate, critique, and groupwork 1. Have skills in thinking, analyzing and evaluating Ho Chi Minh's thoughts. 2. Have skills in presenting, explaining, criticizing, debating and eloquent about theoretical knowledge being studied and researched based on practice. 3. Have skills in creatively applying Ho Chi Minh's thoughts to solving practical problems in life, study and work. III. Attitudes 1. Recognize the role and value of Ho Chi Minh's thoughts for the Party and nation of Vietnam 2. Have political bravery, patriotism, loyalty to the goals and ideals of national independence associated with socialism 3. Recognize responsibility in studying, researching and applying knowledge in life to contribute to national construction and defense

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: period (1 period = 50 minutes)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction</td><td>1</td><td>I, T</td></tr>
<tr><td>Concept, subject, research methodology and meaning of Ho Chi Minh ideology module</td><td>2</td><td>T</td></tr>
<tr><td>The foundation, formation and development of Ho Chi Minh ideology</td><td>3</td><td>T</td></tr>
<tr><td>Ho Chi Minh ideology on national independence and socialism</td><td>3</td><td>T, U</td></tr>
<tr><td>Ho Chi Minh ideology on the Communist Party of Vietnam of the people, by the people and for the people</td><td>3</td><td>T, U</td></tr>
<tr><td>Ho Chi Minh ideology on national great unity and international solidarity</td><td>3</td><td>T, U</td></tr>
<tr><td>Ho Chi Minh ideology on culture, morality and human</td><td>3</td><td>I, T</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Class discussion; Group presentations and reports; Mid-term exam: Multiple choice (closed-book) or essay (opened-book); Final exam: Essay (opened-book)</td></tr>
<tr><td>Study and examination regulations</td><td>- Regulations on assessment: according to the Regulations on the teaching and learning of Political Theory subjects of the School of Political and Administration Sciences.
- Regulations on group presentation: Forming a group: 5 students/group.
+ The deadline for group topic registration on the forum is session 2.
+ Week 4 (4th session) begin to present in order. Note that the presenting groups need to fully show up and bring along all relevant documents.
+ Submission form: submit files and minutes of group work via email to the lecturer.</td></tr>
<tr><td>Materials</td><td>1. Ministry of Education and Training (2019). Giáo trình Tư tưởng Hồ Chí Minh, National Political Publishing House, Hanoi.
2. School of Political and Administration Sciences VNU-HCM. Tài liệu hướng dẫn học tập Tư tưởng Hồ Chí Minh.
3. Ho Chi Minh (2011). Full volume, National Political Publishing</td></tr>
</table>

	House, Hanoi. 4. *Biography of Ho Chi Minh* (2016). National Political Publishing House, Hanoi.

21. Critical Thinking (PE008IU)

Course designation	*This course provides the nature and techniques of thought as a basis for our claims, beliefs, and attitudes about the world. The course also explores the process in which people develop their claims and support their beliefs.* *Specifically, the course includes the theory and practice of presenting arguments in oral and written forms, making deductive and inductive arguments, evaluating the validity or strength of arguments, detecting fallacies in arguments, and refuting fallacious arguments.* *Resources for the reasoning process include hypothetical and real-life situations in various fields of natural sciences, social sciences, and humanities.*
Semester(s) in which the course is taught	1, 2, summer semester
Person responsible for the course	Trần Thanh Tú (Ph.D); Nguyễn Thị Thủy (Ph.D); Phạm Ngọc (Ph.D); Nguyễn Văn Tiếp (Ph.D); Vũ Tiến Thịnh (MA); Đỗ Thị Diệu Ngọc (MA)
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lectures, discussions, homework assignments, students' presentations
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the course	None

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course, students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Know the general concepts and standards of critical thinking; and comprehend the disadvantages of barriers to critical thinking in various contexts
CLO2. Know the elements of an argument and two patterns of reasoning
CLO3 Know the fallacies of relevance and insufficient evidence in arguments</td></tr>
<tr><td>Skill</td><td>CLO4. Construct and evaluate deductive and inductive arguments in spoken and written forms
CLO5. Test the validity of deductive arguments using Venn diagram and truth tables
CLO6. Analyze and standardize arguments
CLO7. Evaluate truth claims and refute arguments
CLO8. Analyze weaknesses in inductive arguments to strengthen them</td></tr>
<tr><td>Attitude</td><td>CLO9. Defend personal/group beliefs with good arguments and in appropriate manners (project presentations)</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (2 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to Critical thinking</td><td>3</td><td>I, T, U</td></tr>
<tr><td>Recognizing arguments</td><td>3</td><td>T, U</td></tr>
<tr><td>Basic logical concepts</td><td>3</td><td>T, U</td></tr>
<tr><td>A little categorical logic</td><td>3</td><td>T, U</td></tr>
<tr><td>A little propositional logic</td><td>3</td><td>T, U</td></tr>
<tr><td>Logical fallacies I</td><td>3</td><td>T, U</td></tr>
<tr><td>Logical fallacies II</td><td>3</td><td>T, U</td></tr>
<tr><td>Review for Midterm test</td><td>3</td><td>U</td></tr>
<tr><td>Analyzing arguments</td><td>3</td><td>T, U</td></tr>
<tr><td>Evaluating arguments and truth claims</td><td>3</td><td>T, U</td></tr>
<tr><td>Inductive reasoning</td><td>3</td><td>T, U</td></tr>
<tr><td>Project: Group presentation</td><td>9</td><td>U</td></tr>
<tr><td>Review for Final Exam</td><td>3</td><td>U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>40 multiple-choice questions for the midterm and final exams and group presentations for the final project</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Overall passing score: 50/100</td></tr>
</table>

Reading list	**Textbooks:** [1] Bassham, Irwin, Nardone, and Wallace, *Critical Thinking: A Student's Introduction*, 6th edition, McGraw-Hill Education, 2019 [2] Moore, B.N. et al. (2009). *Critical Thinking*, 9th ed. McGraw-Hill **References:** [3] Patrick J. Hurley (2012). *A Concise Introduction to Logic* (11th ed.), Wadsworth, Cengage Learning + Relevant web resources

22. Project Management (PH056IU)

Module designation	*This course is developed to provide the principal concept on project management which was characterized by the project management body of knowledge guide (PMBOK Guide). This guide emphasizes the five project process groups of initiating, planning, executing, controlling and closing, and the nine knowledge areas of project integration, scope, time, cost, quality, human resources, communication, risk, and procurement management. Students will also apply all project management knowledge in a specific satellite development project to understand more about satellite life cycle via a mini project and final report. In addition, this course also provides computer aid for project management by introducing the application of Microsoft Project and project scheduling.*
Semester(s) in which the module is taught	1, 2, summer semester
Person responsible for the module	Dr. Lê Xuân Huy
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the module	None

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Show the understanding of important aspects of project management</td></tr>
<tr><td>Skill</td><td>CLO2. Show the abilities of formulating, organizing and managing projects.
CLO3. Show the abilities of team working</td></tr>
<tr><td>Attitude</td><td>CLO4. Show the recognition of professional ethics and responsibilities in formulating, managing and executing projects.</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>+ Course introduction
+ Introduction of Project management
+ The project life cycle and organization</td><td>1</td><td>I</td></tr>
<tr><td>- Project management processes for a project
+ Stakeholders Interaction
+ Project Planning & Control</td><td>1</td><td>T, U</td></tr>
<tr><td>Project Planning Phase
- Communication
- Stakeholders
- Scope
- Work breakdown structure (WBS)</td><td>1</td><td>T, U</td></tr>
<tr><td>- Resource management
+ Critical path method – Crashing a project
+ Resource allocation problem
+ Resource loading
+ Resource leveling</td><td>1</td><td>T, U</td></tr>
</table></td></tr>
</table>

	+ Constrained resource scheduling			
	- Schedule management. + Constructing the network: AON & AOA + Gannt chart + Solving the network	1	T, U	
	- Project cost management Project budgeting & Cost estimation + Top-Down budgeting + Bottom-Up budgeting + Improving the process of cost estimation	1	T, U	
	- Mini project (for a pico satellite development project) - Planning Phase - Review	1	T, U	

	- Mini project (for a pico satellite development project) - Planning Phase - Review	1	T, U
	- Risk management. + Risk management planning + Risk identification + Risk analysis + Risk monitoring and control + Using Crystal Ball software	1	T, U
	- Project quality management + Plan quality + Perform quality assurance + Perform quality control	1	T, U
	- Project human resource management + Develop human resource plan + Acquire project team + Develop project team + Manage project team	1	T, U
	- Project procurement management + Plan procurements + Conduct procurements + Administer procurements + Close procurements	1	T, U
	- Project control Phase. + Gather data + Integrate and analyze data + Access & recommendation actions + Implementation and Monitor Impact.	1	T, U
	- Project (for a pico satellite development project) closing - Presentation of term project (part 1)	1	T, U
	- Presentation of term project (part 2) - Review	1	T, U

Examination forms	Project
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	**Textbooks:** [1] *A Guide to the project management body of knowledge* (PMBOK® Guide). 4th Edition, Newtown Square, Pa.: Project Management Institute, Inc., 2008. [2] Jack R. Meredith ; Samuel J Mantel, *Project management: a managerial approach*. 7th edition, Hoboken, N.J.: Wiley ; Chichester : John Wiley [distributor], 2018. **References:** [3] Jason Westland, *The project management life cycle*. Kogan Page Limited, 2006.

FOREIGN LANGUAGE

23. Writing AE1 (Academic Writing) (EN007IU)

Course designation	*This course provides students with comprehensive instructions and practice in essay writing, including transforming ideas into different functions of writing such as process, cause-effect, comparison-contrast, and argumentative essays.*
Semester(s) in which the course is taught	1, 2, summer semester
Person responsible for the course	Lecturers of School of Languages
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 85 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 25 Private study including examination preparation, specified in hours: 60
Credit points/ECTS	2 credits/3.08 ECTS
Required and recommended prerequisites for joining the course	Students must fulfill ONE of the following requirements to attend this course: ● hold TOEFL iBT certificate with score ≥ 61 ● hold IELTS certificate with score ≥ 5.5 ● have completed IE2 course

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course, students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CL)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Understand and follow different steps in the writing process to produce a complete essay
CLO2. Employ different methods to improve their writing such as peer feedback and teacher comments</td></tr>
<tr><td>Skill</td><td>CLO3. Read critically, analyze and annotate an academic text
CLO4. Use different functions of writing to successfully communicate their purposes to the audience (describe a process, discuss the causes and effects, compare and contrast, make arguments, paraphrase and summarize)</td></tr>
<tr><td>Attitude</td><td>CLO5. Reason around ethical issues in writing academic essays and avoid committing plagiarism</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (2 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>The process of Academic Writing</td><td>1</td><td>I, T, U</td></tr>
<tr><td>Using Outside Sources</td><td>3</td><td>T, U</td></tr>
<tr><td>From Paragraph to Essay</td><td>4</td><td>T, U</td></tr>
<tr><td>Process Essays</td><td>4</td><td>T, U</td></tr>
<tr><td>Cause/Effect Essays</td><td>4</td><td>T, U</td></tr>
</table></td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td>Comparison/ Contrast Essays</td><td>4</td><td>T, U</td></tr>
<tr><td>Argumentative Essays</td><td>6</td><td>T, U</td></tr>
<tr><td>Summarizing</td><td>2</td><td>U</td></tr>
<tr><td>Review & Correction</td><td>2</td><td>U</td></tr>
</table>
</td></tr>
<tr><td>Examination forms</td><td>Essay writing</td></tr>
<tr><td>Study and examination requirements</td><td>
Attendance

Regular on-time attendance in this course is expected. A student will be allowed no more than three absences. It is compulsory that the students attend at least 80% of the course to be eligible for the final examination.

Missed Tests

Students are not allowed to miss any of the tests (both Mid-term and Final). There are very few exceptions. Only with extremely reasonable excuses (eg. certified paper from doctors), students may retake the examination.

Class Behaviors

Students are required to treat their studying in college as a full-time job and spend an adequate amount of time for this Writing AE1 course with approximately 8-10 hours per week (both in class and self-study). Accordingly, students are supposed to follow the obligations below:

- Prepare thoroughly for each class in accordance with the course syllabus and complete home assignments as the instructor’s request.
- Participate fully and constructively in all course activities and discussions (if any).
- Display appropriate courtesy to all involved in the class.
- Provide constructive feedback to faculty members regarding their performance.

Plagiarism

Students are warned not to copy from other books or from their peers for all assessment tasks. Committing plagiarism will result in 0 point for the task. Students who plagiarize
</td></tr>
</table>

	twice will be prohibited from sitting the final examination. *Writing Center (Room 509)* Students are encouraged to visit the Writing Center to schedule an appointment for additional help with essay writing.
Reading list	[1] Oshima, A., & Hogue, A. (2017). *Longman Academic Writing Series, Level 4: Essays* (5th ed.). New Jersey, NJ: Pearson Longman. [2] Oshima, A., & Hogue, A. (2006). *Longman Academic Writing Series, Level 4: Essays* (4th ed.). New Jersey, NJ: Pearson Longman.

24. Listening AE1 (Listening & Note-taking) (EN008IU)

Course designation	*The course is designed to prepare students for effective listening and note-taking skills, so that they can pursue the courses in their majors without considerable difficulty. The course is therefore lecture-based in that the teaching and learning procedure is built up on lectures on a variety of topics such as business, science, and humanities.*
Semester(s) in which the course is taught	1, 2, summer semester
Person responsible for the course	Lecturers of School of Languages
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 85 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 25 Private study including examination preparation, specified in hours: 60
Credit points/ECTS	2 credits/3.08 ECTS
Required and recommended prerequisites for joining the course	Students must fulfill ONE of the following requirements to attend this course: ● hold TOEFL iBT certificate with score ≥ 61 ● hold IELTS certificate with score ≥ 5.5 ● complete IE2 course

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course, students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Remember different strategies and techniques in listening to academic lectures and taking notes.
CLO2. Improve their specialized knowledge of academic lectures</td></tr>
<tr><td>Skill</td><td>CLO3. Respond to academic lectures with appropriate strategies
CLO4. Communicate effectively with their classmates and professors.</td></tr>
<tr><td>Attitude</td><td>CLO5. Respond to academic lectures with confidence</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (2 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Orientation & Introduction of strategies and techniques in note-taking</td><td>2</td><td>I, T, U</td></tr>
<tr><td>Chapter 1: New Trends in Marketing Research</td><td>3</td><td>T, U</td></tr>
<tr><td>Chapter 2: Business Ethics</td><td>3</td><td>T, U</td></tr>
<tr><td>Chapter 3: Trends in Children’s Media Use</td><td>2</td><td>T, U</td></tr>
<tr><td>Chapter 4: The Changing Music Industry</td><td>2</td><td>T, U</td></tr>
<tr><td>Chapter 5: The Placebo Effect</td><td>2</td><td>T, U</td></tr>
<tr><td>Midterm Sample Test & Review</td><td>2</td><td>T, U</td></tr>
<tr><td>Chapter 6: Intelligent Machines</td><td>3</td><td>T, U</td></tr>
<tr><td>Chapter 7: Sibling Relationships</td><td>3</td><td>T, U</td></tr>
<tr><td>Chapter 8: Multiple Intelligences</td><td>3</td><td>T, U</td></tr>
<tr><td>Chapter 9: The Art of Graffiti</td><td>3</td><td>T, U</td></tr>
<tr><td>Final Sample Test & Review</td><td>2</td><td>T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Paper and pen tests: Correct the mistakes, Fill in the blanks, Write short answers, Write a summary paragraph.</td></tr>
</table>

Study and examination requirements	*Attendance* Regular on-time attendance in this course is expected. It is compulsory that students attend at least 80% of the course to be eligible for the final examination. *Missed tests* Students are not allowed to miss any of the tests (both on-going assessment and final test). There are very few exceptions. (Only with extremely reasonable excuses, e.g. certified paper from doctors, may students retake the tests.) *Class behavior* Students are supposed to: • prepare thoroughly for each class in accordance with the syllabus and complete all assignments upon the instructor's request • participate fully and constructively in all class activities (and discussions if any) • display appropriate courtesy to all involved in the class • provide constructive feedback to faculty members regarding their performance
Reading list	*[1]* Frazie, L., & Leeming, S. (2013). *Lecture ready 3.* Oxford: Oxford University Press. References: [2] Frazie, L., & Leeming, S. (2013). *Lecture ready 1, 2.* Oxford: Oxford University Press.

25. Writing AE2 (Research Paper Writing) (EN011IU)

Course designation	*This course introduces basic concepts in research paper writing, especially the role of generalizations, definitions, classifications, and the structure of a research paper to students who attend English- medium college or university. It also provides them with methods of developing and presenting an argument, a comparison or a contrast.*
Semester(s) in which the course is taught	1, 2, summer semester
Person responsible for the course	Lecturers of School of Languages
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 85 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 25 Private study including examination preparation, specified in hours: 60
Credit points/ECTS	2 credits/3.08 ECTS
Required and recommended prerequisites for joining the course	Students must complete Writing AE1 course

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course, students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Understand the structure of a research paper and employ appropriate academic language in writing a research paper</td></tr>
<tr><td>Skill</td><td>CLO2. Read critically, analyze, and annotate academic articles and journals
CLO3. Employ the research writing skills obtained to work on their own paper in their major study.</td></tr>
<tr><td>Attitude</td><td>CLO4. Reason around ethical issues in writing research paper and avoid committing plagiarism</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (2 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Unit 1: The Academic Writing Process Introduction</td><td>4</td><td>I, T, U</td></tr>
<tr><td>Unit 2: Researching and Writing</td><td>2</td><td>T, U</td></tr>
<tr><td>Unit 3: Fundamentals & Feedback</td><td>2</td><td>T, U</td></tr>
<tr><td>Unit 4: Definitions, Vocabulary & Clarity</td><td>2</td><td>T, U</td></tr>
<tr><td>Unit 5: Generalizations, Facts and Honesty</td><td>4</td><td>T, U</td></tr>
<tr><td>Unit 6: Seeing Ideas and Sharing Texts</td><td>2</td><td>T, U</td></tr>
<tr><td>Unit 7: Description, Methods & Reality</td><td>2</td><td>T, U</td></tr>
<tr><td>Unit 8: Results, Discussion & Relevance</td><td>2</td><td>T, U</td></tr>
<tr><td>Unit 9: The Whole Academic Text</td><td>2</td><td>T, U</td></tr>
<tr><td>Unit 10: Creating the Whole Text</td><td>4</td><td>T, U</td></tr>
<tr><td>Course Review</td><td>2</td><td>U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Essay writing</td></tr>
</table>

Study and examination requirements	*Attendance* Regular on-time attendance in this course is expected. A student will be allowed no more than three absences. It is compulsory that the students attend at least 80% of the course to be eligible for the final examination. *Assignment (Literature review)* Purpose: Students will use the knowledge of paraphrasing, summarizing, developing arguments, and APA styles to write a 1,000-word literature review on a research scope of their choice. Task: - Follow guidelines on how to write a literature review. - Use relevant academic writing skills such as paraphrasing, summarizing, developing arguments, and APA 7th Style Guidelines – see https://www.apastyle.org/ - Develop arguments in relation to the research scope and identify the research gap **Notes:** All papers should be typed, double-spaced, in 13-pt font, and with 1-inch margins. All papers must be original for this class. Criterion-referenced grading is used in this course. *Missed Tests* Students are not allowed to miss any of the tests (both Mid-term and Final). There are very few exceptions. Only with extremely reasonable excuses (eg. certified paper from doctors), students may re- take the examination. *Class Behaviors* Students are required to treat their studying in college as a full-time job and spend an adequate amount of time for this Writing AE2 course with approximately 8-10 hours per week (both in class and self- study). Accordingly, students are supposed to follow the obligations below: - Prepare thoroughly for each class in accordance with the course syllabus and complete home assignments as the instructor's request. - Participate fully and constructively in all course activities and discussions (if any). - Display appropriate courtesy to all involved in the class. - Provide constructive feedback to faculty members regarding their performance. *Plagiarism* All forms of plagiarism and unauthorized collusion are seriously regarded and could result in penalties. Plagiarism occurs when students copy or reproduce

<table>
<tr>
<td></td>
<td>
people's words or ideas and then present them as students' own work without proper acknowledgement, including when students copy the work of their fellow students.
Plagiarism in student submissions can be detected by:
· some web-based programs such as SafeAssign or Turnitin, or
· examiner's judgments with evidence of originals
The rater will review the paper to check if citations or references are provided properly. Penalties due to improper citations or references include:
<table>
<tr><th>Degree of magnitude</th><th>Description</th></tr>
<tr><td>Below 15%</td><td>Marked as it is.</td></tr>
<tr><td>15% - 25%</td><td>The score is deducted by 25%.</td></tr>
<tr><td>25% - 40%</td><td>The score is deducted by 50%</td></tr>
<tr><td>Over 40%</td><td>The score is 0.</td></tr>
</table>
Notes: Part of the test is marked as it is if no plagiarism is detected. Students who plagiarize over 40% twice will be prohibited from sitting the final examination.
Writing Center (Room 509)
Students are encouraged to visit the Writing Center or to schedule an appointment for additional help.
</td>
</tr>
<tr>
<td>Reading list</td>
<td>
[1] Hamp-Lyons, L., & Heasley, B. (2006). Study Writing. Cambridge, UK: Cambridge University Press
[2] Articles and Essays taken from The Allyn and Bacon Guide to Writing by Ramage et al (2009), Pearson Longman.
[3] Cormack, J. & Slaught, J. (2009). English for academic study: Extended writing and research skills. Cambridge: Cambridge University Press. Garnet Education
[4] Folse, K. S. & Pugh, T. (2010). Great writing 5: Greater essays. Boston: Heinle, Cengage Learning.
[5] Keezer, S. (Ed.) (2003). Write your research report: A real-time guide. New Jersey: Pearson Learning Group.
[6] Kumar, R. (2019). Research methodology: A step-by-step guide for beginners. Sage Publications
</td>
</tr>
</table>

26. Speaking AE2 (Effective Presentations) (EN012IU)

Course designation	*Giving presentations today becomes a vital skill for students to succeed not only in university but also at work in the future. Speaking AE2, therefore, provides students with the knowledge and skills needed to deliver effective presentations (informative and persuasive presentations).*
Semester(s) in which the course is taught	1, 2, summer semester
Person responsible for the course	Lecturers of School of Languages
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, mini presentations
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 85 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 25 Private study including examination preparation, specified in hours: 60
Credit points/ECTS	2 credits/3.08 ECTS
Required and recommended prerequisites for joining the course	Students must complete AE1 courses
Course objectives	Speaking AE2 aims at introducing and training students in many aspects of giving a presentation: building up confidence, preparing and planning, using the appropriate language, applying effective visual aids, applying delivery techniques, dealing with questions and responding, performing body language, and so on.

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course, students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Understand many aspects of giving a presentation: building up confidence, preparing and planning, using the appropriate language, applying effective visual aids, applying delivery techniques, dealing with questions and responding, performing body language</td></tr>
<tr><td>Skill</td><td>CLO2. Prepare and deliver effective, formal, structured presentations that are appropriate to the specific environment and audience.</td></tr>
<tr><td>Attitude</td><td>CLO3. Deliver both informative and persuasive speech with confidence</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (2 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Orientation & Introduction
Needs analysis</td><td>2</td><td>I, T, U</td></tr>
<tr><td>Building up confidence</td><td>2</td><td>T, U</td></tr>
<tr><td>The first few minutes</td><td>2</td><td>T, U</td></tr>
<tr><td>Organizing what you want to say</td><td>2</td><td>T, U</td></tr>
<tr><td>Summarizing and concluding</td><td>2</td><td>T, U</td></tr>
<tr><td>Using equipment</td><td>2</td><td>T, U</td></tr>
<tr><td>Delivery techniques: Putting it all together</td><td>2</td><td>T, U</td></tr>
<tr><td>Group presentations for the instructor’s evaluation and advice</td><td>2</td><td>U</td></tr>
<tr><td>Introduction to persuasive speeches</td><td>2</td><td>T, U</td></tr>
<tr><td>Methods of persuasion</td><td>2</td><td>T, U</td></tr>
<tr><td>Maintaining interest</td><td>2</td><td>T, U</td></tr>
<tr><td>Dealing with problems and questions</td><td>2</td><td>T, U</td></tr>
<tr><td>Body language</td><td>2</td><td>T, U</td></tr>
<tr><td>Individual presentations for the instructor’s evaluation and advice</td><td>4</td><td>U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Oral Presentations</td></tr>
</table>

Study and examination requirements	*Attendance* Regular on-time attendance in this course is expected. A student will be allowed no more than three absences. It is compulsory that the students attend at least 80% of the course to be eligible for the final examination. *Missed Tests* Students are not allowed to miss any of the tests (both Mid-term and Final). There are very few exceptions. Only with extremely reasonable excuses (e.g. certified paper from doctors), students may retake the examination. *Class Behaviors* Students are required to treat their studying in college as a full-time job and spend an adequate amount of time for this Speaking AE2 course with approximately 8-10 hours per week (both in class and self-study). Accordingly, students are supposed to follow the obligations below: ● Prepare thoroughly for each class in accordance with the course syllabus and complete home assignments as the instructor's request. ● Participate fully and constructively in all course activities and discussions (if any). ● Display appropriate courtesy to all involved in the class. ● Provide constructive feedback to faculty members regarding their performance. *Plagiarism* Students are warned not to copy from other books or from their peers for all assessment tasks. Committing plagiarism will result in 0 point for the task. Students who plagiarize twice will be prohibited from sitting the final examination.

Reading list	[1] Lowe, S, & Pile, L. (2010). *Presenting.* Singapore*:* Cengage Learning [2] Comfort, J. (1997). *Effective presentations*. Oxford: Oxford University Press [3] Lucas, S. (2014). *The art of public speaking* (12th edition). New York: McGraw-Hill Education. [4] Harrington, D., & Lebeau, C. (2009). *Speaking of speech*. Macmillan

CORE COURSES

27. Introduction to Space Engineering (PH018IU)

Module designation	*This introductory course will bring a general overview of Space Science and Engineering to students, including the background of space and solar physics and the historical development of Space Engineering throughout the XX century. Since the course is designed from the engineers' point of view, prospective students with strong interests in Space Science and Engineering will be provided with solid foundations of the field, as well as the finest motivations for the needs of Vietnam for space science, space technology and applications in the XXI century.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Assoc. Prof. Phan Bảo Ngọc
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 85 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 25 Private study including examination preparation, specified in hours: 60
Credit points/ECTS	2 credits/3.08 ECTS
Required and recommended prerequisites for joining the module	None

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Describe basic concepts and roles of Space Science and Engineering in the era of Space Exploration.</td></tr>
<tr><td>Skill</td><td>CLO2. Express ideas by using the appropriate means of graphical communications or oral presentations.</td></tr>
<tr><td>Attitude</td><td>CLO3. Recognize the need of further self-learning in Space Science and Engineering.</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (2 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction and History</td><td>1</td><td>I, T</td></tr>
<tr><td>Part 1: Space Science
Chapter 1: Orbital Mechanics</td><td>2</td><td>I, T</td></tr>
<tr><td>Chapter 2: Planetary Science</td><td>2</td><td>I, T</td></tr>
<tr><td>Chapter 3: Space Physics</td><td>3</td><td>I, T</td></tr>
<tr><td>Part 2: Satellite Technology
Chapter 4: Introduction to Satellites and their Applications</td><td>2</td><td>I, T</td></tr>
<tr><td>Chapter 5: Remote Sensing</td><td>2</td><td>I, T</td></tr>
<tr><td>Chapter 6: Navigation Systems</td><td>2</td><td>I, T, U</td></tr>
<tr><td>Chapter 7: Space Telescopes</td><td>1</td><td>I, T</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Exam</td></tr>
</table>

Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	**Textbooks:** [1] *Tools of Radio Astronomy,* T. L. Wilson, K. Rohlfs. Huttemeister, 5th Edition, Springer [2] Anil K. Maini & VarshaAgrawal (2011). *Satellite Technology Principles and Applications,* A John Wiley and Sons, Ltd., Publication. **References:** [3] *Galactic Astronomy (Princeton Series in Astrophysics)*, James Binney and Michael Merrifield, Princeton University Press [4] *Galactic Dynamics*, James Binney and Scott Tremaine, Princeton University Press [5] *Remote Sensing and Image Interpretation*, Thomas M. Lillesand and Ralph W. Kiefer, Wiley.

28. Earth Observation and the Environment (PH027IU)

Module designation	*This course gives students an understanding of the Earth's climate system, an appreciation of the environmental issues (water pollution, air pollution, soil pollution, etc), and also sheds light on the role of Earth's climate system, which may have on the space systems, especially the negative impacts. Some engineering approaches are suggested to suppress these negative impacts in maintaining the lifetime of the space systems in their services.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Assoc. Prof. Hồ Quốc Bằng
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the module	None

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Describe components of the Earth’s climate system and its impacts on environmental issues.</td></tr>
<tr><td>Skill</td><td>CLO2. Explain environmental issues using the Earth’s observations.</td></tr>
<tr><td>Attitude
-</td><td>CLO3. Identify the impact of the Earth’s climate change and observation techniques on society and environmental issues.</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>
The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Chapter 1: Introduction
Overview of the environment
Importance of environment for quality of life
Importance of Earth observation to solve environmental issues</td><td>2</td><td>I, T</td></tr>
<tr><td>Chapter 2: Earth's environment
Description Earth’s environment as a system
Identification of the key environment system components and their characteristics and interactions</td><td>3</td><td>I, T</td></tr>
<tr><td>Chapter 3: Key environmental issues relevant to Earth observation
Local (pollution), regional (acid rain), and global (ozone depletion, climate change)</td><td>2</td><td>I, T</td></tr>
<tr><td>Chapter 4: Earth observation techniques
Methods of measuring key geophysical parameters ($PM_{2.5}$, weather, etc) by satellite</td><td>3</td><td>I, T</td></tr>
<tr><td>Chapter 5: Applications of Earth observation
Overview of different sectors (agriculture, etc.)</td><td>2</td><td>I, T</td></tr>
<tr><td>Chapter 6: Climate change
Science, impacts and policy</td><td>3</td><td>I, T</td></tr>
</table>
</td></tr>
<tr><td>Examination forms</td><td>Exam</td></tr>
</table>

Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	**Textbooks:** [1] *Satellite Technology, Principles and Technology,* Anil K. Maini & Varsha A., Wiley, 2011. [2] *Remote sensing: Principles and Applications,* Floyd F. Sabins, Waveland Press, Inc. (1997) **References**: [3] Quoc Bang Ho. 2016. *Urban Air Pollution: from theory to practice*. 420 pages. NXB ĐHQG Tp.HCM, 2016 [4] Quoc Bang Ho. 2016. *Climate change and response measures* 520 pages. VNU HCM Presse, 2016 [5] Quoc Bang Ho, Hoang Ngoc Khue Vu, Thoai Tam Nguyen, Thi Thuy Hang Nguyen, Nguyen Thi Thu Thuy. 2019. *A combination of bottom-up and top-down approaches for calculating air emission for developing countries: A case of Ho Chi Minh city, Vietnam. Air Quality, Atmosphere & Health* volume 12, pages 1059–1072(2019).

29. Introduction to relativity and modern physics (PH029IU)

Module designation	*This course is introductory to all theoretically fundamental aspects of Special Relativity and Early Quantum Theory. In the first part of the course, students are brought up with some experiments that lead to the special relativity concepts of objects moving at speed close to the speed of light. From there, they can develop the formalism of special relativity in both kinematics and dynamics via the discussion of moving frames of reference, Galilean and Lorentz transformations, and electromagnetism. The second part of the course will also introduce the other pillar of modern physics, quantum theory, in its early stage. Again, students will get acquainted with some experiments that led to the thoughts of quantization, the duality characteristics of the particle-wave nature of radiation, and the principle of uncertainty; and apply these foundation physics backgrounds to the quantum theory of the atom then.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Assoc. Prof. Phan Bảo Ngọc
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, assignment
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the module	Previous course General Physics 3 (PH023IU) (or Physics 4 (PH012IU)), Calculus 2 (MA003IU)

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Solve physics problems of objects moving at speeds comparable to the speed of light and objects having sizes comparable to the atomic scale by using basic concepts of Special Relativity and Quantum Theory.</td></tr>
<tr><td>Skill</td><td>CLO2. Express ideas by using the appropriate means of graphical communications or oral presentations</td></tr>
<tr><td>Attitude</td><td>CLO3. Recognize the need of further self-learning in Special Relativity and Quantum Theory.</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Chapter 1: Background of Special Relativity</td><td>3</td><td>I, T</td></tr>
<tr><td>Chapter 2: Relativistic Kinematics</td><td>2</td><td>I, T</td></tr>
<tr><td>Chapter 3: Relativistic Dynamics</td><td>2</td><td>I, T</td></tr>
<tr><td>Chapter 4: Quantization of Energy</td><td>2</td><td>I, T</td></tr>
<tr><td>Chapter 5: The Particle Nature of Radiation</td><td>2</td><td>I, T</td></tr>
<tr><td>Chapter 6: Wave Nature of Matter and Uncertainty Principle</td><td>2</td><td>I, T</td></tr>
<tr><td>Chapter 7: Early Quantum Theory of Atom</td><td>2</td><td>I, T</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Exam</td></tr>
</table>

Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	**Textbooks:** [1] Basic Concepts in Relativity and Early Quantum Theory, Resnick & Halliday – 2nd Edition. **References:** [2] Becchi, Carlo M., and Massimo D'Elia. Introduction to the Basic Concepts of Modern Physics. Springer (2007).

30. Introduction to Signals and Systems (PH032IU)

Module designation	*Introduction to continuous- and discrete-time systems and signals, basis function representation of signals, convolution, Fourier Series, Fourier, Laplace, Z-transform theory, state space variable analysis of linear systems, basic feedback concepts.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Dr. Tôn Thất Long
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, assignment.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the module	Previous course General Physics 2 (PH021IU) (or Physics 3 (PH015IU), Differential Equations (PH026IU or MA024IU)

Module objectives/intended learning outcomes	Upon the successful completion of this course students will be able to:	
	Competency level	**Course learning outcome (CLO)**
	Knowledge	CLO1. Understand the fundamentals of signals and systems in both discrete time and continuous time domains and their representatives in practice and apply knowledge of methods (Fourier transform, Laplace transform, z transform) to analyze the characteristics of signals and system.
	Skill	CLO2. Differentiating the nature of discrete time and continuous time systems in order to devise proper methods to solve engineering problems related to these systems
	Attitude	CLO3. Recognize the need of further self-learning in signals and systems.

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction of signal</td><td>1</td><td>I, T,U</td></tr>
<tr><td>System & System Properties</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Discrete time and Continuous time Convolution methods</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Linear Time Invariant System Properties</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Fourier Series and Fourier Transforms</td><td>3</td><td>I, T,U</td></tr>
<tr><td>Laplace Transform</td><td>2</td><td>I, T,U</td></tr>
<tr><td>z-Transform and its properties</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Sampling</td><td>1</td><td>I, T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	**Textbook:** [1] A. Poularikas, *Signals and Systems with Primer with MATLAB*, CRC Press, 2007. [2] V. Oppenheim, A. S. Willsky with S. Hamid, *Signals and Systems*, Prentice Hall, 2nd ed., 1996. **Other supplemental materials** [1] B.P. Lathi, Linear Systems and Signals, Oxford University Press Inc., 2005. [2] Lecture notes

31. Signals and Systems Laboratory (PH033IU)

Module designation	*This course covers the following topics: Experimental exercises via simulation using MATLAB to get an understanding of frequency and time domain analysis of linear dynamic systems and corresponding signals. Finding the response of continuous-time and discrete-time linear systems via simulation*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Dr. Huỳnh Võ Trung Dũng
Language	English
Relation to curriculum	Compulsory
Teaching methods	Laboratory, Exercises.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 55 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 25 Private study including examination preparation, specified in hours: 30
Credit points/ECTS	1 credit/2 ECTS
Required and recommended prerequisites for joining the module	Parallel course: Introduction to Signals and Systems (PH032IU)

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Review the fundamentals of signals and systems.</td></tr>
<tr><td>Skill</td><td>CLO2. Design and conduct experiment, analyze results
CLO3. Use MATLAB software to write programs about some signals and systems topics and know how to write lab report</td></tr>
<tr><td>Attitude</td><td>CLO4. Understand the professional and ethical responsibility as an engineer</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: laboratory session (4 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to MATLAB</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Elementary Signals</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Mathematical Description of Signals</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Systems</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Fourier Series</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Time-Domain System Analysis and Laplace Transform</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Fourier Transform and Fourier Analysis Discrete-Time Signals</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Review and Final Examination</td><td>1</td><td>I, T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Exam</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>Textbook:
[1] Laboratory Manual supplied by the instructor.
Reference:
[2] Z. Gajic, Linear Dynamic Systems and Signals, Prentice-Hall, 2003</td></tr>
</table>

32. Introduction to Space Communications (PH035IU)

Module designation	*This course is introductory to all fundamental aspects of Space Communications between a spacecraft (or satellites) and the ground stations. The scopes of the course cover a wide range of discussions from the satellite's technological designs and technical solutions to its communications with the controlled-ground stations. In the first part of the course, students will study the essential characteristics and components of satellites, the satellite launching methods, the satellite orbits (mainly concentrating on the geostationary satellites), and the satellite orbital perturbations; nevertheless, in the second part, the learning contents will focus on the analog and digital signals, transmissions, receptions, link equations, and satellite services.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Dr. Nguyễn Ngọc Trường Minh
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the module	Previous course: General Physics 2 (PH021IU) or Physics 3 (PH015IU)

<table>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="2">Upon the successful completion of this course students will be able to:</td></tr>
<tr><td></td><td>Competency level</td><td>Course learning outcome (CLO)</td></tr>
<tr><td></td><td>Knowledge</td><td>CLO1. Apply the knowledge of mathematics and physics to solve engineering problems.
CLO2. Demonstrate the understanding of the fundamental principles of satellite communications, satellite orbits, and satellite designs.</td></tr>
<tr><td></td><td>Skill</td><td>CLO3. Show abilities of expressing ideas using graphical communications or oral presentations</td></tr>
<tr><td></td><td>Attitude</td><td>CLO4. Show the role and responsibility of an engineer in society</td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Overview of Satellite Systems</td><td>1</td><td>I</td></tr>
<tr><td>Orbital and Launching Methods</td><td>1</td><td>I, T</td></tr>
<tr><td>The Geostationary Orbit</td><td>1</td><td>I, T</td></tr>
<tr><td>Polarization</td><td>1</td><td>I, T</td></tr>
<tr><td>Introduction to Antennas</td><td>1</td><td>I, T</td></tr>
<tr><td>Antenna Fundamental Parameters</td><td>1</td><td>I, T</td></tr>
<tr><td>The Space and Earth Segment</td><td>1</td><td>I, T</td></tr>
<tr><td>Analog Signals</td><td>1</td><td>I, T</td></tr>
<tr><td>Digital Signals</td><td>1</td><td>I, T</td></tr>
<tr><td>Error Correcting Codes</td><td>2</td><td>I, T</td></tr>
<tr><td>Interference
Satellite Network</td><td>1</td><td>I, T</td></tr>
<tr><td>Direct Broadcast Satellite (DBS) Television
Satellite mobile and Specialized Services</td><td>2</td><td>I, T</td></tr>
<tr><td>Group Presentation
Review 2</td><td>1</td><td>U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Short-answer questions</td></tr>
</table>

Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	**Textbooks:** *[1]* D. Roddy, *Satellite Communications,* 4th edition, McGraw–Hill, 2006 [2] Lecture notes [3] T. Prat, C. W. Bostian, *Satellite Communications*, 2nd edition, John Wiley & Sons, 2002 **References:** [4] *Satellite Technology, Principles and Technology*, Anil K. Maini & Varsha A., Wiley, 2011. [5] *Satellite Communications Payload and System*, T.M. Braun, Weyley, 2012 [6] *Satellite Communication Systems Engineering*, 2nd edition, W. L. Pritchard, H. G. Suyderhoud, R. A. Nelson, Prentice Hall, 1992

33. Remote Sensing (PH036IU)

Module designation	*In this course, students will be able to extract physical information of the Earth's surface using remote sensing, applying for forestry, agriculture, water resources, and environment. Wavelength ranges used in this course are ultraviolet, visible, short-wavelength infrared, thermal infrared, and microwave.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Dr. Phan Hiền Vũ
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, assignment.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the module	Previous course: General Physics 3 (PH023IU) Parallel Course: General Physics 3 Laboratory (PH024IU)

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Explain geophysical measurements derived from remotely sensed data with a wide range from visible to microwave wavelengths
CLO2. Develop applications in forest, agriculture, water resources and environment using remote sensing data</td></tr>
<tr><td>Skill</td><td>CLO3. Classify land surface from optical and thermal remote sensing images</td></tr>
<tr><td>Attitude</td><td>CLO4. Show the impact of remote sensing techniques for natural resource and environmental management, and sustainable development.</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Chapter 1: Introduction to Concepts and Systems</td><td>2</td><td>T</td></tr>
<tr><td>Chapter 2: Photographs and Digital Images from Aircraft and Satellites</td><td>3</td><td>T</td></tr>
<tr><td>Chapter 3: Earth Resource and Environmental Satellites</td><td>3</td><td>T</td></tr>
<tr><td>Chapter 4: Thermal Infrared Images</td><td>2</td><td>T</td></tr>
<tr><td>Chapter 5: Radar Technology and Terrain Interactions</td><td>2</td><td>T</td></tr>
<tr><td>Chapter 6: Forest, agricultural, water resources and environmental applications</td><td>3</td><td>T</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Exam</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	**Textbooks:** [1] F. F. Sabins, *Remote sensing: Principles and Interpretation*, Waveland Press, Inc. (2007). **References:** [2] W.G. Rees, *Physical principles of remote sensing*, Cambridge University Press (2012). [3] Q. Weng, *Advances in environmental remote sensing: sensors, algorithms, and applications*, CRC Press (2011).

34. Space Environment (PH037IU)

Module designation	*This is an introductory course of physical properties of plasma; the solar atmosphere; the solar dynamo; the magnetic field and the ionosphere of the Earth; the interaction between the solar wind and the magnetic field of the Earth; the impact of the ionosphere on satellite communication.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Assoc. Prof. Phan Bảo Ngọc
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, practice
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the module	Parallel Course: General Physics 2 (PH014IU) (or Physics 3 (PH015IU))

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1: Demonstrate fundamental concepts of plasma, solar physics such as solar atmosphere, solar activities, and solar dynamo, geomagnetism and Earth’s ionosphere.</td></tr>
<tr><td>Skill</td><td>CLO2: Explain the physical processes in space such as the interaction between the solar wind and Earth's magnetic fields.</td></tr>
<tr><td>Attitude</td><td>CLO3: Identify the impact of space environment on satellite communication, emerging space technologies, and on solutions to typical problems in space engineering.</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table><tr><th>Topic</th><th>Weight</th><th>Level</th></tr><tr><td>Part A: Atmospheric structure and physical processes in some regions of space
Chapter 1: Plasma Physics</td><td>2</td><td>I, T</td></tr><tr><td>Chapter 2: Solar physics</td><td>3</td><td>I, T</td></tr><tr><td>Chapter 3: Solar Wind</td><td>3</td><td>I, T</td></tr><tr><td>Chapter 4: Geomagnetism</td><td>2</td><td>I, T</td></tr><tr><td>Chapter 5: Magnetosphere</td><td>2</td><td>I, T</td></tr><tr><td>Chapter 6: Neutral Atmosphere</td><td>2</td><td>I, T</td></tr><tr><td>Chapter 7: Ionosphere</td><td>1</td><td>T, U</td></tr></table></td></tr>
<tr><td>Examination forms</td><td>Exam</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	**Textbooks:** [1] Tamas I. Gombosi, *Physics of the Space Environment (Cambridge Atmospheric and Space Science Series),* Cambridge University Press; Revised ed. edition (2004) **References:** [2] Francis F. Chen, Introduction to Plasma Physics and controlled fusion, second edition (1974) [3] Davies, Kenneth. *Ionospheric radio*. No. 31. IET (1990) [4] Hargreaves, John Keith. *The solar-terrestrial environment: an introduction to Geospace-the science of the terrestrial upper atmosphere, ionosphere, and magnetosphere*. Cambridge university press (1992)

35. Satellite technology (PH040IU)

Module designation	*This course is introductory to general knowledge about satellites, including two parts separately of satellite technology and applications. The first part of the course will introduce students to the fundamental topics of satellite technology, satellite orbits, and satellite launching. The second part of the course focuses mostly on satellite applications, including communication techniques, remote sensing, navigation, weather satellites, and military satellites.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Dr. Lê Xuân Huy
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the module	None

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Show the understanding of main satellite applications for developing and functioning satellite/spacecraft systems.
CLO2. Show basic knowledge of designing payloads, instruments, and bus systems of a satellite/spacecraft mission</td></tr>
<tr><td>Skill</td><td>CLO3. Express the ability of teamwork skills</td></tr>
<tr><td>Attitude</td><td>CLO4. Recognize the state of space business and space industry in the world and in Vietnam.</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to Satellite technologies and Application</td><td>1</td><td>I, T</td></tr>
<tr><td>Space Environments</td><td>1</td><td>I, T</td></tr>
<tr><td>Satellite Orbits</td><td>1</td><td>I, T</td></tr>
<tr><td>Satellite System Engineering</td><td>1</td><td>I, T</td></tr>
<tr><td>Mission Design</td><td>1</td><td>I, T</td></tr>
<tr><td>Power subsystem</td><td>1</td><td>I, T</td></tr>
<tr><td>Communications subsystem</td><td>1</td><td>I, T</td></tr>
<tr><td>Command and data-handling subsystem</td><td>1</td><td>I, T</td></tr>
<tr><td>Attitude determination and Control System 1</td><td>1</td><td>I, T</td></tr>
<tr><td>Attitude determination and Control System 2</td><td>1</td><td>I, T</td></tr>
<tr><td>Assembly, Integration and Test</td><td>1</td><td>I, T</td></tr>
<tr><td>Ground station and Mission control and operation</td><td>1</td><td>I, T</td></tr>
<tr><td>Space Project Management</td><td>1</td><td>I, T</td></tr>
<tr><td>New Space and Traditional space 1</td><td>1</td><td>I, T</td></tr>
<tr><td>New Space and Traditional space 2</td><td>1</td><td>U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Project</td></tr>
</table>

Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	**Textbooks:** [1] Anil K. Maini & Varsha Agrawal (2011). *Satellite Technology: Principles and Applications*, A John Wiley and Sons, Ltd., Publication) **References:** [2] James R. Wertz, Wiley J. Larson, *Space Mission Analysis and Design*, Third Edition [3] Miguel A. Aguirre, *Introduction to Space Systems: Design and Synthesis*, 2013th Edition [4] Wilfried Ley, Klaus Wittmann, Willi Hallmann, *Handbook of Space Technology*, Aerospace Series, 2009

36. iOS Programming Fundamentals (PH055IU)

Module designation	*This course provides students with an introduction to programming on the iOS platform with Swift Programming language including: environment, syntax, data types, variables, tuples, constants, literals, operators, decision making, loops, strings, arrays, sets, functions, classes, properties, methods, OOP concepts, App development methodologies, UI designs.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	MSc. Trương Thị Ngọc Phượng
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, project, practice
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 182.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5, laboratory: 25 Private study including examination preparation, specified in hours: 120
Credit points/ECTS	4 credits (3theory + 1 practice)/6.62 ECTS
Required and recommended prerequisites for joining the module	Previous course: Programming for Engineers (EE057IU)

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Apply the knowledge of informatics to solve engineering problems.
CLO2. Apply the Swift Language to develop iOS applications.</td></tr>
<tr><td>Skill</td><td>CLO3. Implement programs on iOS using the Swift language and app development tools.</td></tr>
<tr><td>Attitude</td><td>CLO4. Recognize the legality, professional ethics and responsibilities, and norms of developing and using the software.</td></tr>
</table></td></tr>
</table>

Content

The description of the contents should clearly indicate the weighting of the content and the level.

Weight: lecture session (5 hours)

Teaching levels: I (Introduce); T (Teach); U (Utilize)

Topic	**Weight**	**Level**
Introduction to Swift Language Architecture of Swift Functions Variable and Simple Types Object Type Flow Control and More	3	I, T
OOP Concepts & Practices Objects, Properties, Classes, methods. Constructor. Inheritance Polymorphism Abstraction Encapsulation.	3	T
Xcode Project Anotomy of an Xcode Project Nib Management Documentation Life Cycle of a Project MVC Concepts	2	T, U
Build the UI UIKit and Interface Builder Build a basic UI Connect the UI to code. Working with View Controllers. Implement custom controls. Define your data model	2	T, U
Working with Multiple View Controllers and Navigation. TableView Navigation Controller.	2	T, U
Working with Core Data. Core Data Entities and Attributes. Data saving Data fetching Data deleting.	1	T, U
Working with Networking Networking services GET request REST & CRUD Decoding1,4A5sync, and POST Request Test and publish apps on App Store	2	T, U

Examination forms	Project
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	**Textbook:** [1] Neuburg, Matt, *iOS 10 programming fundamentals with Swift : Swift, Xcode, and Cocoa basics*, Beijing : O'Reilly, 2017. **Reference:** [2] Greg Lim, *Beginning iOS 13 & Swift App Development: Develop iOS Apps with Xcode 11*, Swift 5, Core ML, ARKit and more, independently published [3] *Beginning Android*, 5th edition, Grant Allen [4] Learning *Android Google Maps*, Raj Amal W.

37. Introduction to Digital Image Processing (PH038IU)

Module designation	*This course will introduce students to essential basic knowledge of creating, visualizing, and manipulating digital images by computer. Topics will include representation of two-dimensional (2D) data, time and frequency domain representations, filtering and enhancement, the Fourier transform, convolution, interpolation, color images, and preliminary knowledge in object recognition and description.*
Semester(s) in which the module is taught	1,2
Person responsible for the module	Dr. Hồ Đình Duẩn
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, homework.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 85 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 25 Private study including examination preparation, specified in hours: 60
Credit points/ECTS	2 credits/3.08 ECTS
Required and recommended prerequisites for joining the module	None

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1: Apply systematically the theoretical aspects of imaging systems in designing, manipulating, and creating 2D digital images.</td></tr>
<tr><td>Skill</td><td>CLO2: Use advanced imaging techniques to create, visualize and manipulate digital images.</td></tr>
<tr><td>Attitude</td><td>CLO3: Show the role and responsibilities of an engineer in related fields.</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>

The description of the contents should clearly indicate the weighting of the content and the level.

Weight: lecture session (3 hours)

Teaching levels: I (Introduce); T (Teach); U (Utilize)

<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction and organization, physics of vision, resolution, impulse response</td><td>1</td><td>I, T</td></tr>
<tr><td>Linear systems, matrix transformations, scaling, translation, rotations and other geometric transformation; image registration and interpolation</td><td>1</td><td>I, T</td></tr>
<tr><td>Contrast and gray levels, histograms, Gaussian, and other non-linear stretches</td><td>1</td><td>I, T</td></tr>
<tr><td>Convolution, simple filters, edge detection</td><td>1</td><td>I, T</td></tr>
<tr><td>The frequency domain, power spectral density, the FFT</td><td>1</td><td>I, T</td></tr>
<tr><td>Digital filtering, image enhancement, noise</td><td>1</td><td>I, T</td></tr>
<tr><td>The fast Fourier transforms</td><td>1</td><td>I, T</td></tr>
<tr><td>The convolution theorem</td><td>1</td><td>I, T</td></tr>
<tr><td>Color representation, RGB, HSI, 24 bit and 8 bit color tables</td><td>1</td><td>I, T</td></tr>
<tr><td>3D information, perspective plots</td><td>1</td><td>I, T</td></tr>
<tr><td>Topography and shaded relief display, contours, parallax, and stereo</td><td>1</td><td>I, T</td></tr>
<tr><td>Image morphing</td><td>1</td><td>I, T</td></tr>
<tr><td>Interpolation</td><td>1</td><td>I, T</td></tr>
<tr><td>Fitting smooth functions to sparse data, least-squares</td><td>1</td><td>I, T</td></tr>
<tr><td>False color images, principal components analysis</td><td>1</td><td>I, T</td></tr>
</table>

</td></tr>
<tr><td>Examination forms</td><td>Exam</td></tr>
</table>

Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	**Textbooks:** [1] Handouts [2] Scott Umbaugh (1998). *Computer Vision and Image Processing,* Prentice-Hall, Inc., Upper Saddle River, New Jersey. **References:** *[3]* Abramowitz, M., and I. A. Stegun (1964). *Handbook Of Mathematical Functions with Formulas, Graphs, And Mathematical Tables,* U.S. Govt. Print. Off., Washington. [4] Bracewell, R. N. (1986). *The Fourier Transform and Its Applications,* McGraw-Hill, New York, 2nd edition. *[5]* Goodman, J.W. (1968). *Introduction to Fourier Optics*, McGraw-Hill, New York. *[6]* Pratt, W.K. (1978). *Digital Image Processing,* John Wiley and Sons, New York. [7] Lillesand and Kiefer (1994). *Remote Sensing and Image Interpretation,* Third Edition, Wiley, New York.

38. Digital Image Processing Laboratory (PH039IU)

Module designation	*This course gives students computer-based laboratory exercises designed to introduce methods of real-world data manipulation. The lab exercises will introduce various imaging processing topics, which could be completed with many widely used programming languages such as Matlab, C, or Python.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Dr. Hồ Đình Duẩn
Language	English
Relation to curriculum	Compulsory
Teaching methods	Laboratory report.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 55 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): laboratory: 25 Private study including examination preparation, specified in hours: 30
Credit points/ECTS	1 credit/2 ECTS
Required and recommended prerequisites for joining the module	Parallel Course: Introduction to Digital Image Processing (PH038IU)

Module objectives/intended learning outcomes	Upon the successful completion of this course students will be able to:	
	Competency level	**Course learning outcome (CLO)**
	Knowledge	CLO1. Apply the basic knowledge of digital imaging processing and manipulating on computers in designing, manipulating, and creating 2D digital images.
	Skill	CLO2. Use many widely used programming languages such as Matlab, C/C++, or Python at advanced levels.
	Attitude	CLO3. Show the legal issues and responsibilities in engineering practice.

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: laboratory session (4 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Viewing digital images, bits and bytes, raster scan format, quantization</td><td>1</td><td>T, U</td></tr>
<tr><td>Scaling, translation and rotation, sums and differences</td><td>1</td><td>T, U</td></tr>
<tr><td>Histograms and stretches, convolutional filters</td><td>1</td><td>T, U</td></tr>
<tr><td>Fourier transforms and the frequency domain, filters</td><td>1</td><td>T, U</td></tr>
<tr><td>FFTs, Image filtering: smoothing and sharpening</td><td>1</td><td>T, U</td></tr>
<tr><td>2D convolution and correlation</td><td>1</td><td>T, U</td></tr>
<tr><td>Color and color tables</td><td>1</td><td>T, U</td></tr>
<tr><td>Creating multiple image sequences for the project</td><td>1</td><td>T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Exam</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	**Textbooks:** [1] Handouts **References:** [2] Scott Umbaugh (1998). *Computer Vision and Image Processing,* Prentice-Hall, Inc., Upper Saddle River, New Jersey. [3] Pratt, W.K. (1978). *Digital Image Processing,* John Wiley and Sons, New York

39. Optics and Photonics (PH031IU)

Module designation	*This course will cover the basics of physical optics and photonics, the applications of photonics such as fiber optic communication and photon detectors.*
Semester(s) in which the course is taught	1, 2
Person responsible for the course	Dr. Trịnh Xuân Thắng
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, assignment, homework
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 85 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 25 Private study including examination preparation, specified in hours: 60
Credit points/ECTS	2 credits/3.08 ECTS
Required and recommended prerequisites for joining themodule	Previous Course: General Physics 3 (PH023IU) (or Physics 4 (PH012IU)), orAnalytical Physics IIB (IS014IU)

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Apply knowledge of optics and photonics into photonics applications such as fiber optic communication and photon detectors</td></tr>
<tr><td>Skill</td><td>CLO2. Express ideas using the appropriate means of graphical communications or oral presentations</td></tr>
<tr><td>Attitude</td><td>CLO3. Recognize the need of further self-learning in optics and photonics.</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (2 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Chapter 1: Nature of light</td><td>2</td><td>I, T</td></tr>
<tr><td>Chapter 2: Light propagation I</td><td>2</td><td>T</td></tr>
<tr><td>Chapter 3: Light propagation II</td><td>2</td><td>T, U</td></tr>
<tr><td>Chapter 4: Fourier optics</td><td>2</td><td>T, U</td></tr>
<tr><td>Chapter 5: Optical fibre</td><td>2</td><td>T, U</td></tr>
<tr><td>Chapter 6: Physics of lasers</td><td>1</td><td>T, U</td></tr>
<tr><td>Chapter 7: Semiconductor photon sources</td><td>2</td><td>T, U</td></tr>
<tr><td>Chapter 8: Photon detectors</td><td>2</td><td>T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Exam</td></tr>
</table>

Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	**Textbook:** [1] Lecture notes [1] Saleh, B.E.A., *Fundamentals of photonics* , New Jersey : Wiley, 2007. **Reference:** [3] *Laser Electronics*, J.T. Verdeyen, 3rd edition [4] *Fundamentals of Physics*, Halliday, Resnick, Walker, 9th edition

MAJOR COURSES

40. Big Data Analytics for Remote Sensing (PH053IU)

Module designation	*The aim of the course is to get students familiar with high-performance computing aspects of remote sensing. Students will learn how to discover knowledge from remote sensing data with high-performance computing approaches and data visual analytics tools (Apache Hadoop, parallel Python, R, Google Earth Engine).*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Dr. Lê Thanh Vân
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, assignment, project.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the module	Previous Course: Programming for engineers (EE057IU), Earth Observation and Environment (PH027IU), Remote Sensing (PH036IU)

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Develop algorithms of analyzing big data in remote sensing using high-performance computing approaches and data visual analytics tools.</td></tr>
<tr><td>Skill</td><td>CLO2. Analyze data to make conclusions to engineering problems in big data and remote sensing.</td></tr>
<tr><td>Attitude</td><td>CLO3. Show abilities of further self-learning and lifelong learning.</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to remote sensing big data</td><td>1</td><td>I, T</td></tr>
<tr><td>Infrastructure and high-performance computing for remote sensing data</td><td>2</td><td>I, T</td></tr>
<tr><td>Hadoop and Map Reduce</td><td>2</td><td>I, T</td></tr>
<tr><td>Distributed database</td><td>1</td><td>T, U</td></tr>
<tr><td>The computing platforms: parallel computing (CPUs and GPUs), Cloud computing</td><td>1</td><td>T, U</td></tr>
<tr><td>Python for Big Data</td><td>2</td><td>T, U</td></tr>
<tr><td>R - advanced spatial statistics for remote sensing big data</td><td>1</td><td>T, U</td></tr>
<tr><td>Remote sensing image handling: Image Enhancement, Data Mining</td><td>2</td><td>T, U</td></tr>
<tr><td>The open platform: Google Earth Engine</td><td>2</td><td>T, U</td></tr>
<tr><td>Final project: Thematic mapping from remote sensing big data</td><td>1</td><td>U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Short answer question, project.</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	**Textbooks:** [1] *Big Data: Techniques and Technologies in Geoinformatics*, Hassan A. Karimi (editor), 2014, CRC Press. **References:** [2] *High Performance Computing in Remote Sensing, Antonio* J. Plaza and Chein-I Chang (editors), 2008, Chapman & Hall/CRC Computer and Information Science Series. [3] *Hadoop: The Definitive Guide*, 2nd edition, Tom White, 2011, O'Reilly. [4] *An Introduction to R for Spatial Analysis and Mapping (Spatial Analytics and GIS),* Chris Brunsdon, Lex Comber, second edition [5] *Big Data Analysis with Python: Combine Spark and Python to unlock the powers of parallel computing and machine learning*, Ivan Marin, Ankit Shukla, Sarang VK, 2019 **Software:**

41. Big Data Analytics for Remote Sensing Laboratory (PH054IU)

Module designation	*This course provides students with hands-on experience of handling remote sensing big data. Students will work with the latest development tools and platforms such as Apache Hadoop, parallel Python, R, Google Earth Engine.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Dr. Lê Thanh Vân
Language	English
Relation to curriculum	Compulsory
Teaching methods	Practice.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 55 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): laboratory: 25 Private study including examination preparation, specified in hours: 30
Credit points/ECTS	1 credit/2 ECTS
Required and recommended prerequisites for joining the module	Parallel course: Big Data Analytics for Remote Sensing (PH053IU)

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Apply the knowledge of the latest tools of big data analytics in remote sensing.</td></tr>
<tr><td>Skill</td><td>CLO2. Analyze data to make conclusions to engineering problems in big data and remote sensing.</td></tr>
<tr><td>Attitude</td><td>CLO3. Show the need of for further self-learning of big data analytics for remote sensing.</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: laboratory session (4 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Getting started with the computing resources
○ Parallel computing: CPUs and GPUs
○ Cloud computing</td><td>1</td><td>T, U</td></tr>
<tr><td>Python programming for big data</td><td>1</td><td>T, U</td></tr>
<tr><td>R - advanced spatial statistics for remote sensing big data</td><td>2</td><td>T, U</td></tr>
<tr><td>Remote sensing image handling: Image Enhancement, Data Mining</td><td>2</td><td>T, U</td></tr>
<tr><td>Remote sensing thematic mapping on Google Earth Engine platform</td><td>2</td><td>T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Take experiment and write report</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	**Textbooks:** [1] Handouts **References:** [2] *Hadoop: The Definitive Guide*, 2nd edition, Tom White, 2011, O'Reilly. [3] *Big Data: Techniques and Technologies in Geoinformatics*, Hassan A. Karimi (editor), 2014, CRC Press. [4] *High Performance Computing in Remote Sensing, Antonio* J. Plaza and Chein-I Chang (editors), 2008, Chapman & Hall/CRC Computer and Information Science Series **Software:**

42. Navigation systems (PH047IU)

Module designation	*This course introduces the principles of space navigation systems based on inertial sensors and satellite navigation. Students will start with a development history of many global navigation satellite systems (GNSS) such as GPS, GLONASS, EGNOS, Galileo, etc. and then will build upon the modern navigation systems, GPS, with Coordinate Frames, Time Reference, and Orbits to estimate the position, velocity, and times, as well as their errors. Besides, the course also provides the learners with based knowledge of GPS signals and GPS Signal Conditioning and Acquisition utilizing the Fourier transformation and convolution.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Dr. Nguyễn Chánh Nghiệm, Dr. Lương Bảo Bình
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project, exam.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the module	None

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1: Show the understanding of operation of global navigation satellite systems, e.g. GPS.</td></tr>
<tr><td>Skill</td><td>CLO2: Analyze the GPS data for geolocation on the Earth surface from receivers e.g. handheld devices, base stations and RTK rovers.</td></tr>
<tr><td>Attitude</td><td>CLO3: Show the impact of GNSS in society and environments.</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Part 1: Fundamentals
Chapter 1: Introduction
Overview of navigation principles
Typical applications, Axis systems and projections</td><td>1</td><td>I, T</td></tr>
<tr><td>Chapter 2: Inertial Navigation Systems
Principles of inertial navigation
Accelerometers, gyroscopes, specific technologies such as Ring Laser Gyros
Axis transformations and mechanization of IN equations,
Errors in inertial navigation</td><td>1</td><td>T</td></tr>
<tr><td>Chapter 3: GPS: An overview
Objectives, Policies, and Status
System Architecture, Signals
Receivers, Measurements, and Performance
Applications</td><td>1</td><td>T</td></tr>
</table></td></tr>
</table>

	Chapter 4: GNSS Development history: GNSS, GPS, GLONASS, EGNOS, Galileo GPS system architecture (ground, space, user segment), Code (CDMA) and carrier techniques	2	T, U
	Chapter 5: GPS Coordinate Frames, Time Reference, and Orbits Global Coordinate Systems Time References and GPS Time GPS Orbits and Satellite Position Determination	2	T, U
	Part 2: Estimation of Position, Velocity, and Time Chapter 6: GPS Measurements and Error Sources Measurement Models Control Segment Errors: Satellite Clock and Ephemeris, Signal Propagation Modeling Errors Measurement Errors	1	U
	Chapter 7: PVT Estimation Position Estimation with Pseudoranges Position and Velocity from Pseudorange Rates Time Transfer	1	T, U
	Part 3: GPS Signals Chapter 8: Signals and Linear Systems Overview, Convolution Transfer Functions and Basis Functions Fourier Series, Fourier Transform Random Signals, Laplace Transform	1	T, U
	Chapter 9: GPS Signals	1	T, U
	Chapter 10: Signal-to-Noise Ratio and Ranging Precision	2	T, U
	Part 4: Receivers Chapter 11: Signal Conditioning and Acquisition Signal Conditioning Signal Acquisition Statistical Analysis of Signal Acquisition	2	T, U
Examination forms	Project/Written examination		

Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	**Textbooks**: [1] *Global Positioning System, Signals Measurements, and Performance,* 2nd Edition, 2012 by P. Misra and P. Enge, Ganga-Jamuna Press. **References:** [2] *Leick, A. GPS satellite surveying. New York:* Wiley & Sons, 1994. 19 p. ISBN 0-471-30626-6 [3] Elliott Kaplan, Christopher J. Hegarty*, Understanding GPS/GNSS: Principles and Applications,* Third edition.

43. Geolocation App Development for iOS (PH057IU)

Module designation	*This course provides students with an introduction to programming on the iOS platform with Swift Programming language for location-based services apps, including Core Location services, Maps, Region monitoring, iBeacon, Compass Heading, Geocoding, Error Handling, and Firebase. In addition, this course gives students skills to design, implement & debug a program for the iOS platform.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	MSc. Trương Thị Ngọc Phượng
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, Laboratory, project.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 182.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5, laboratory: 25 Private study including examination preparation, specified in hours: 120
Credit points/ECTS	4 credits (3theory + 1 practice)/6.62 ECTS
Required and recommended prerequisites for joining the module	Previous course: iOS Programming fundamentals (PH055IU)

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Integrate Core Data Framework, Core Location Framework and Map Kit into iOS apps.</td></tr>
<tr><td>Skill</td><td>CLO2. Develop applications using iOS programming platform with the Swift language.
CLO3. Write Software Engineering reports in English and explain diagrams</td></tr>
<tr><td>Attitude</td><td>CLO4: Cooperate effectively with teammates to achieve project goals</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to Core Location Essentials</td><td>1</td><td>I, T</td></tr>
<tr><td>Region Monitoring</td><td>2</td><td>T</td></tr>
<tr><td>iBeacon</td><td>2</td><td>T, U</td></tr>
<tr><td>Compass Heading</td><td>1</td><td>T, U</td></tr>
<tr><td>Geocoding & Maps</td><td>2</td><td>T, U</td></tr>
<tr><td>Error Handling and App Development</td><td>1</td><td>U</td></tr>
<tr><td>Swift language</td><td>2</td><td>T, U</td></tr>
<tr><td>Xcode Project</td><td>2</td><td>T, U</td></tr>
<tr><td>GPS Programming</td><td>2</td><td>T, U</td></tr>
</table></td></tr>
</table>

Examination forms	Project
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	**Textbooks:** *[1]* iOS *10 Programming Fundamentals with Swift,* 2017 third edition, Matt Neuburg. [2] *Geolocation in iOS,* Alasdair Allan 2012 O'Reilly **References:** [3] *Beginning Android*, 5th edition, Grant Allen [4] *Learning Android Google Maps*, Raj Amal W

44. Digital Signal Processing (EE092IU)

Module designation	*This course is an introduction to the basic principles, methods, and applications of digital signal processing, emphasizing its algorithmic, computational, and programming aspects. In particular, the students will learn the conversion from analog to digital, the concepts of discrete time linear systems, filtering, spectral analysis of discrete time signals and filter design*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Dr. Huỳnh Võ Trung Dũng
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, assignment.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the module	Previous course: Introduction to Signals and Systems (PH032IU)

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Apply knowledge of mathematics, science and engineering to solve digital signal processing problem.</td></tr>
<tr><td>Skill</td><td>CLO2. Understand the sampling, quantization process as well as the basic discrete-time systems concepts.
CLO3. Illustrate the design of digital filter by various methods to meet prescribed specifications</td></tr>
<tr><td>Attitude</td><td>CLO4. Confidence and fluency in discussing digital signal processing in English</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction. Sampling and reconstruction</td><td>1</td><td>T</td></tr>
<tr><td>Quantization</td><td>2</td><td>T, U</td></tr>
<tr><td>Discrete-time systems</td><td>1</td><td>T, U</td></tr>
<tr><td>FIR filtering and convolution</td><td>2</td><td>T, U</td></tr>
<tr><td>Z- transforms</td><td>1</td><td>T, U</td></tr>
<tr><td>Transfer function</td><td>1</td><td>T, U</td></tr>
<tr><td>Digital filter realization</td><td>2</td><td>T, U</td></tr>
<tr><td>DFT/FFT algorithms</td><td>1</td><td>T, U</td></tr>
<tr><td>Signal processing applications. Class project</td><td>2</td><td>T, U</td></tr>
<tr><td>Filter design techniques (FIR, IIR)</td><td>2</td><td>T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Written Exam</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	**Textbooks:** [1] S. J. Orfanidis, *Introduction to Signal Processing*, 2nd Ed, Prentice –Hall, 1996 [2] Class notes **Reference:** [3] A. V. Oppenheim, R. W. Schafer, Discrete-time Signal Processing, 2nd Ed, Prentice Hall [4] V. K. Ingle and J. G. Proakis, Digital Signal Processing Using Matlab, PWS Publishing Company

45. Digital Signal Processing Laboratory (EE093IU)

Module designation	*This course is an introduction to the basic principles, methods, and applications of digital signal processing, emphasizing its algorithmic, computational, and programming aspects.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Dr. Huỳnh Võ Trung Dũng
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, Experiment, assignment
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 55 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): laboratory: 25 Private study including examination preparation, specified in hours: 30
Credit points/ECTS	1 credits/2 ECTS
Required and recommended prerequisites for joining the module	Parallel course: Digital Signal Processing (EE092IU)

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Design and implement digital signal processing algorithms in MATLAB software.</td></tr>
<tr><td>Skill</td><td>CLO2. Optimize the programming code for having better performance of DSP projects.
CLO3. Solve the problems efficiently by individual and by group.
CLO4. Present the application of DSP algorithms in signal processing filed</td></tr>
<tr><td>Attitude</td><td>CLO5. Confidence and fluency in discussing digital signal processing in English</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: laboratory session (4 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table><tr><th>Topic</th><th>Weight</th><th>Level</th></tr><tr><td>Sampling and reconstruction of analog signals</td><td>1</td><td>T, U</td></tr><tr><td>Sampling, Quantizing and Coding</td><td>1</td><td>T, U</td></tr><tr><td>Z transform</td><td>1</td><td>T, U</td></tr><tr><td>Z transform and Transfer Function</td><td>1</td><td>T, U</td></tr><tr><td>Fourier Analysis of Discrete-Time Signals</td><td>1</td><td>T, U</td></tr><tr><td>Frequency Response</td><td>1</td><td>T, U</td></tr><tr><td>Review and Final Exam</td><td>2</td><td>T, U</td></tr></table></td></tr>
<tr><td>Examination forms</td><td>Written Exam</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>Textbooks:
[1] S J.Orfanidis, Introduction to Signal Processing, Prentice–Hall, 1996, ISBN 0-13-209172-0
[2] M. D. Lutovac, D. V. Tošić, B. L. Evans, Filter Design for Signal Processing Using MATLAB and Mathematica, Prentice Hall, 2001
[3] Lab manual</td></tr>
</table>

46. Digital image processing (PH041IU)

Module designation	*This course provides advanced topics in digital image processing. In-class students will be provided in-depth theoretical knowledge of professional themes, including segmentation, morphological image processing, linear image filtering, imaging correlation, imaging transforms, eigenimage, multiresolution image processing, noise reduction and restoration, feature extraction, and recognition tasks.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Dr. Hồ Đình Duẩn
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the module	Previous course: Introduction to Digital Image Processing (PH038IU)

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Develop algorithms for digital image analysis and interpretation in engineering areas.</td></tr>
<tr><td>Skill</td><td>CLO2. Analyze digital images using various platforms and programming languages.</td></tr>
<tr><td>Attitude</td><td>CLO3. Show abilities of further self-learning and lifelong learning.</td></tr>
</table></td></tr>
</table>

Content

The description of the contents should clearly indicate the weighting of the content and the level.

Weight: lecture session (3 hours)

Teaching levels: I (Introduce); T (Teach); U (Utilize)

Topic	**Weight**	**Level**
Introduction	1	I, T
Point Operations, local and global operations for image segmentation.	1	I, T
Differential operators for segmentation: Gradient and Laplacian.	1	I, T
Histograms revisited and Statistics-based segmentation.	1	I, T
Color Science.	1	I, T
Feature representation.	1	I, T
Morphological Image Processing.	1	I, T
Linear Image Processing and Filtering.	1	I, T
Template Matching.	1	I, T
Eigen images.	1	I, T
Feature descriptors.	1	I, T
Fourier and Morphology-based descriptors.	1	I, T
Scale-Space Image Processing.	1	I, T
Feature-based Methods for Image Matching.	1	I, T
Image classification and simple recognition.	1	U

Examination forms	Project /Exam.
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	**Textbook:** [1] Scott Umbaugh (1998). *Computer Vision and Image Processing*, Prentice-Hall, Inc., Upper Saddle River, New Jersey. [2] Lecture notes **References:** [3] Abramowitz, M., and I. A. Stegun (1964). Handbook Of Mathematical Functions with Formulas, Graphs, And Mathematical Tables, U.S. Govt. Print. Off., Washington. [4] Bracewell, R. N. (1986). The Fourier Transform and Its Applications, McGraw-Hill, New York, 2nd edition. [5] Goodman, J.W. (1968). Introduction to Fourier Optics, McGraw-Hill, New York. [6] Pratt, W.K. (1978). Digital Image Processing, John Wiley and Sons, New York. [7] Lillesand and Kiefer (1994). Remote Sensing and Image Interpretation, Third Edition, Wiley, New York [8] Gonzalez, R. & Woods R (2008). Digital Image Processing, 3rd Edition, Addison Wesley.

47. Satellite Signal and Image Processing Laboratory (PH043IU)

Module designation	*This course provides students with experiments on transmitting the collected data from satellites to ground-based stations, then performing post-processing data on the ground. Participating students will have a chance to learn how to operate and control satellites and equip them with project management skills.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Dr. Lê Xuân Huy
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, experiment, project.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 152.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 12.5; laboratory session: 50 Private study including examination preparation, specified in hours: lecture: 30; laboratory session: 60
Credit points/ECTS	3 (1 theory + 2 practice) credits/5.54 ECTS
Required and recommended prerequisites for joining the module	Parallel course: Digital signal processing (EE092IU) Introduction to Digital Image processing (PH038IU)

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Analyze processes of operating a satellite system, and collecting, transmitting and post-processing its data.</td></tr>
<tr><td>Skill</td><td>CLO2. Experiment controlling components of a satellite system model and processing its data.
CLO3. Show abilities of team working.</td></tr>
<tr><td>Attitude</td><td>CLO4. Show the impact of satellite-based technological solutions in support of societal and environmental management.</td></tr>
</table></td></tr>
</table>

Content

The description of the contents should clearly indicate the weighting of the content and the level.

Weight: lecture session (3 hours)

Teaching levels: I (Introduce); T (Teach); U (Utilize)

Part A: Theory section

Topic	**Weight**	**Level**
An introduction of satellite signal and image processing course	1	I, T
An introduction of satellite system design, verification and validation process	1	I, T
An introduction Functions Test Process	1	I, T
Function Test in practice: Electrical Power Unit, On-board computer, signal transmission	1	I, T
An introduction to system integration design process	1	I, T

Part B: Practical section

Topic	**Weight**	**Level**
Bus System Integration: Onboard Computer, Signal Transmitter and Power Supply Unit.	2	T, U
Bus System Integration: ADCS components	2	T, U
Payload System Integration	1	T, U
An introduction for system test process	1	T, U
System test in practice: ADCS: Earth pointing, Mission Scenarios planning, Payload operation: Image capture, Data transmission: S-band transmitting, Data post processing	4	T, U

Examination forms	Project.
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	**Textbooks:** [1] *MicroSatKit Manual or equivalence satellite kit for laboratory*. **References:** [2] INCOSE Systems Engineering Handbook. *A Guide for Sy* *Life Cycle Processes and Activities*. [3] Wertz, J. R., Everett, D. F., & Puschell, J. J. (2011). *Space mission engineering: The new SMAD*. Hawthorne, CA: Micro Press. [4] *Charles D. Brown: Elements of spacecraft design*, AIAA, [5] Development of MicroDragon, *the First Vietnamese Mic Satellite*, 30th International Symposium on Space Technology and Science (ISTS), Kobe, Japan, 2015.

48. Antenna and Microwave Engineering (EE105IU)

Module designation	*The course provides students the understanding of radiation fundamentals, linear antennas, point source arrays, aperture antennas, antenna impedance, and antenna systems. Basic concepts of microwave engineering such as transmission lines, Smith plot, microwave circuits, analysis techniques, design and applications.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	MSc. Trần Văn Sư
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, assignment.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the module	Previous course: General Physics 2 (PH021IU) (or Physics 3 (PH015IU) or Electromagnetic Theory (EE010IU))

Module objectives/intended learning outcomes	Upon the successful completion of this course students will be able to:	
	Competency level	**Course learning outcome (CLO)**
	Knowledge	CLO1. Collect in depth the principles of antenna radiation and radiation characteristics (input impedance, gain, half power beam width, and radiation power…).
	Skill	CLO2. Analyze the specific antennas such as: dipoles, loop, parabolic antennas and the antenna arrays
	Attitude	CLO3. Analyze and design topics of microwave engineering such as transmission line, Smith chart, scattering matrix

<table>
<tr><td>Content</td><td>
The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction and a Historical Perspective</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Antenna radiation characteristics: Input impedance, efficiency, radiation power</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Antenna radiation characteristics: radiation patterns, wave polarization, half power beam-width, gain, receiving antenna and antenna link.</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Current radiate field, Maxwell's Equations and Source-Field Relationships, Hertzian dipoles, small loop antennas.</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Finite length dipoles, line sources, ground planes and monopoles.</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Linear arrays, array factor.</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Broadside and endfire arrays. Planar arrays and pattern multiplication.</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Transmission line equations and properties. Standing Wave Patterns And VSWR. Introduction to Smith chart.</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Impedance matching techniques.</td><td>2</td><td>I, T,U</td></tr>
<tr><td>Microwave engineering, scattering matrix.</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Low noise amplifier, power amplifier, Power divider, couplers, filters.</td><td>1</td><td></td></tr>
<tr><td>Review</td><td>1</td><td></td></tr>
</table>
</td></tr>
<tr><td>Examination forms</td><td>Written Exam</td></tr>
</table>

Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	**Textbook:** [1] Class notes **Reference:** [2] C.A. Balanis, Antenna Theory Analysis and Design, John Wiley & Sons, 1997

49. Antenna and Microwave Engineering Laboratory (EE124IU)

Module designation	*Antenna & Microwave Engineering Practical Workbook covers a variety of experiments that are designed to aid students in their profession and theory. They include a variety of topics which include antennas, transmission lines and microwave waveguides. A practical exposure to such equipment is necessary as it builds on the theory taught to students.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	MSc. Trần Văn Sư
Language	English
Relation to curriculum	Compulsory
Teaching methods	Laboratory, lesson, assignment.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 55 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): laboratory: 25 Private study including examination preparation, specified in hours: 30
Credit points/ECTS	1 credits/2 ECTS
Required and recommended prerequisites for joining the module	Parallel course: Antenna and Microwave Engineering (EE105IU)

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Use simulation software to design antennas</td></tr>
<tr><td>Skill</td><td>CLO2. Define and analyze the radiation characteristics of antennas (input impedance, gain, half power beam width, and radiation power, polarization...).
CLO3. Measure and record the experimental data, analyze the results, and prepare a formal laboratory report.
CLO4. Explain to colleagues, through both written and verbal presentations, technical materials as presented in this course</td></tr>
<tr><td>Attitude</td><td>CLO5. Analyze and design topics of microwave engineering such as transmission line, Smith chart, scattering matrix</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: laboratory session (4 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Dipole antenna simulation using HFSS</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Patch antenna simulation using HFSS</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Experimentation with Pyramidal horn and Helical antennas</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Standing Wave & SWR Measurements.</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Transmission lines</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Matching and transformation network.</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Introduction to RF Anechoic chamber and Network analyzer equipment</td><td>1</td><td>I, T,U</td></tr>
<tr><td>Review</td><td>1</td><td>T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Exam</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	**Textbook:** [1] Class notes [2] Laboratory Manual supplied by the instructor. **Reference:** [3] Antenna Fundamentals – Lab-Volt's Document. [4] Microwave Fundamentals – Lab-Volt's Document.

50. Research Project (PH042IU)

Course designation	*This course provides the research project for students, which improves their skills in doing research and has experience in a practical project.*
Semester(s) in which the course is taught	1, 2
Person responsible for the course	Assoc. Prof. Phan Bảo Ngọc Dr. Phan Hiền Vũ MSc. Lê Thị Quế
Language	English
Relation to curriculum	Compulsory
Teaching methods	Project
Workload (incl. contact hours, self-study hours)	12 weeks (180 hours)
Credit points/ECTS	4 credits/6.56 ECTS
Required and recommended prerequisites for joining themodule	None

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Skill</td><td>CLO1. Perform experiments, analyze data, and interpret results to get practical experience in working
CLO2. Cooperate effectively in a team.
CLO3. Show abilities of effective written and oral communication.</td></tr>
<tr><td>Attitude</td><td>CLO4. Show the understanding of the role and responsibility of an engineer in society.
CLO5. Show abilities of further self-learning and lifelong learning.
CLO6. Show the awareness of the legal issues and responsibilities, the commitment to professional ethics and responsibilities, and the norms of developing and using software.</td></tr>
</table></td></tr>
<tr><td>Content</td><td>A group of four or five students choose one of the research projects assigned by professors. The topic is in two fields:
- Space Science
- Space Engineering</td></tr>
<tr><td>Examination forms</td><td>Report and presentation</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>No textbook required</td></tr>
</table>

51. Internship (PH044IU)

Course designation	*Students will start their internship at space center, satellite center and company relating to satellite science and satellite engineering.*
Semester(s) in which the course is taught	Summer of third year
Person responsible for the course	Assoc. Prof. Phan Bảo Ngọc Dr. Phan Hiền Vũ MSc. Lê Thị Quế
Language	English
Relation to curriculum	Compulsory
Teaching methods	Project, practice
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 135 hours
Credit points/ECTS	3 credits/4.92 ECTS
Required and recommended prerequisites for joining themodule	

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course students will be able to:<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Skill</td><td>CLO1. Perform experiments, analyze data, and interpret results to get practical experience in working
CLO2. Cooperate effectively in a team.
CLO3. Communicate effectively in the working environment.</td></tr>
<tr><td>Attitude</td><td>CLO4. Show the understanding of the role and responsibility of an engineer in society.
CLO5. Show abilities of further self-learning and lifelong learning.
CLO6. Show awareness of legal issues and responsibilities, the commitment to professional ethics and responsibilities, and norms of developing and using software.</td></tr>
</table></td></tr>
<tr><td>Content</td><td>Students will follow the guidance of the instructors from space center/satellite center/company.</td></tr>
<tr><td>Examination forms</td><td>Report and presentation</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>Documents, notes from space center/ satellite center</td></tr>
</table>

52. Thesis (PH050IU)

Course designation	*The topics of the thesis focus on space engineering, especially satellite technology and satellite application. Students have a deep understanding about theoretical knowledge and application. Students will also become familiar with research topics, ways of argument and making points according to the research process, which will help them develop a more academic perspective*
Semester(s) in which the course is taught	1, 2
Person responsible for the course	Assoc. Prof. Phan Bảo Ngọc Dr. Phan Hiền Vũ MSc. Lê Thị Quế
Language	English
Relation to curriculum	Compulsory
Teaching methods	Project
Workload (incl. contact hours, self-study hours)	12 weeks (450 hours)
Credit points/ECTS	10 credits/16.4 ECTS
Previous Course	- Successfully finish at least 90% over the total numbers of credits of the academic program - Do not be under any academic warning

<table>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course students will be able to:<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Skill</td><td>CLO1. Perform experiments, analyze data, interpret results, and make conclusions for a practical problem.
CLO2. Show abilities of effective written and oral communication</td></tr>
<tr><td>Attitude</td><td>CLO3. Show an understanding of the role and responsibility of an engineer in society.
CLO4. Show abilities of further self-learning and lifelong learning.
CLO5. Show an awareness of the legal issues and responsibilities, the commitment to professional ethics and responsibilities, and the norms of developing and using software.</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The topic is in two fields:
- Space Science
- Space Engineering</td></tr>
<tr><td>Examination forms</td><td>Thesis report and presentation</td></tr>
<tr><td>Study and examination requirements</td><td>Following the Thesis Guideline of Department of Physics</td></tr>
<tr><td>Reading list</td><td>Depending on the topic</td></tr>
</table>

ELECTIVE COURSES

53. Geographic Information System (GIS) and Spatial Analysis (PH046IU)

Module designation	*This course will focus on the concepts and techniques of GIS. Students will be familiar with data models and structures, database management and spatial analysis and modeling.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Dr. Phan Hiền Vũ
Language	English
Relation to curriculum	Elective
Teaching methods	Lecture, lesson, homework.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 140 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 25, practice: 25 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 (2 theory + 1 practice) credits/5.08 ECTS
Required and recommended prerequisites for joining the module	None

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Design geospatial data structure for management information systems.</td></tr>
<tr><td>Skill</td><td>CLO2. Analyze geospatial data using QGIS tools</td></tr>
<tr><td>Attitude</td><td>CLO3. Show an understanding of the role and responsibility of an engineer in fields related to geospatial data.
CLO4. Show abilities of further self-learning and long-life learning.</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Chapter 1: Introduction to Geograp Information Systems (GIS)</td><td>1</td><td>T</td></tr>
<tr><td>Chapter 2: Maps and Geospatial Data</td><td>1</td><td>T</td></tr>
<tr><td>Chapter 3: Digital Representation and Organization of Geospatial Data</td><td>1</td><td>T</td></tr>
<tr><td>Chapter 4: Geospatial Data Quality and Standards</td><td>1</td><td>T</td></tr>
<tr><td>Chapter 5: Raster Geo-processing</td><td>1</td><td>T, U</td></tr>
<tr><td>Chapter 6: Vector Geo-processing</td><td>1</td><td>T, U</td></tr>
<tr><td>Chapter 7: Geo-visualization and Geospatial Information Products</td><td>2</td><td>T, U</td></tr>
<tr><td>Chapter 8: Digital Terrain Modeling, Management of Imagery and Elevation Data</td><td>1</td><td>T, U</td></tr>
<tr><td>Chapter 9: Spatial Data Analysis, Modeling and Mining</td><td>3</td><td>T, U</td></tr>
<tr><td>Chapter 10: Remote Sensing and GI Integration</td><td>1</td><td>T, U</td></tr>
<tr><td>Chapter 11: GIS Implementation and Project Management</td><td>1</td><td>T</td></tr>
<tr><td>Chapter 12: GIS Issues and Prospects</td><td>1</td><td>T</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Exam, project, report.</td></tr>
</table>

Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	**Textbooks:** [1] Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind. *Geographic Information Science and Systems,* 4th Edition, Wiley, 2015. **References:** [2] Keith C. Clarke, *Getting Started with Geographic Information Systems*, Prentice Hall, 1999. [3] Yue-Hong Chou, *Exploring Spatial analysis in Geographic Information Systems*, On WordPress, 1997. [4] Aronoff, S., *Geographic Information Systems: A Management Perspective*, WDL Publications, Ottawa, 1991. [5] Bernhardsen, T., *Geographic Information Systems: An Introduction*, John Wiley and Sons, New York, 2002. [6] Bolstad, P., *GIS Fundamentals, A First Text on Geographic Information Systems*, Eider Press, White Bear Lake, Minnesota, 2005. [7] Chang, K., *Introduction to Geographic Information Systems,* McGraw Hill Higher Education, 2008. **Software:** QGIS

54. Advanced Remote Sensing (PH049IU)

Module designation	*This course provides knowledge and skills of digital image processing for extracting environmental information from satellite and airborne imaging systems. Applications of pre-processing, enhancement, classification, and modeling image processing routines are for environmental monitoring, modeling, and management, and applicable for biological, terrestrial, atmospheric, and oceanic sciences.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Dr. Phan Hiền Vũ
Language	English
Relation to curriculum	Elective
Teaching methods	Lecture, lesson, project.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the module	Previous course: Remote sensing (PH036IU), Introduction to Digital Image Processing (PH038IU)

Module objectives/intended learning outcomes	Upon the successful completion of this course students will be able to:	
	Competency level	**Course learning outcome (CLO)**
	Knowledge	CLO1. Develop applications of remote sensing in natural disasters and environmental pollution.
	Skill	CLO2. Experiment remotely sensed data for monitoring natural hazards and environment, such as drought, flooding, sea level rise, air pollution, urban expansion, etc.
	Attitude	CLO3. Show the impact of remote sensing techniques for disaster risk and environmental management, and sustainable development.

Content

The description of the contents should clearly indicate the weighting of the content and the level.

Weight: lecture session (3 hours)

Teaching levels: I (Introduce); T (Teach); U (Utilize)

Topic	**Weight**	**Level**
Chapter 1 Remote sensing and digital image processing	1	T
Chapter 2 Remote sensing data collection	1	T, U
Chapter 3 Digital image processing hardware and software	1	T, U
Chapter 4 Image Quality Assessment and Statistical Evaluation	1	T, U
Chapter 5 Display Alternatives and Scientific Visualization	1	T, U
Chapter 6 Electromagnetic Radiation Principles and Radiometric Correction	1	T, U
Chapter 7 Geometric Correction	2	T, U
Chapter 8 Image Enhancement	1	T, U
Chapter 9 Thematic Information Extraction: Pattern Recognition	1	T
Chapter 10 Information Extraction Using Artificial Intelligence	1	T
Chapter 11 Change Detection	2	T, U
Chapter 12 Remote Sensing–Derived Thematic Map Accuracy	2	T, U

Examination forms	Short-answer questions
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	**Textbooks:** [1] Jensen, J.R, *Introductory digital image processing: a remote sensing perspective*, 4th edition, Pearson, 2015. **References:** [2] Q. Weng, *Advances in environmental remote sensing: sensors, algorithms, and applications*, CRC Press (2011). [3] W.G. Rees, *Physical principles of remote sensing*, Cambridge University Press (2012).

55. Emerging Engineering Technologies (EE133IU)

Module designation	*This course will explore current breakthrough technologies and disruptive innovations that have recently emerged in the past few years. A close examination of the technology will be conducted to understand the application using the new technologies. The class is a series of seminars on each of the emerging technologies*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Dr. Nguyễn Đình Uyên
Language	English
Relation to curriculum	Specialization
Teaching methods	Lecture, lesson, homework.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the module	None

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Provide the depth of students' knowledge in a new and recently emerged technologies
CLO2. Provide the introduction into the applications for the emerging technologies</td></tr>
<tr><td>Skill</td><td>CLO3. To apply the new and emerging technology in an application</td></tr>
<tr><td>Attitude</td><td></td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Humanoid Robot.</td><td>1</td><td>I,T</td></tr>
<tr><td>Drone Technology</td><td>1</td><td>I,T</td></tr>
<tr><td>Artificial Intelligent Control System</td><td>1</td><td>I,T</td></tr>
<tr><td>Microsoft Azure Cloud Computing
Platform</td><td>1</td><td>I,T</td></tr>
<tr><td>Hyperspectral Imaging</td><td>1</td><td>I,T</td></tr>
<tr><td>3D printing technology</td><td>1</td><td>I,T</td></tr>
<tr><td>Nano Technology</td><td>1</td><td>I,T</td></tr>
<tr><td>IOT platforms</td><td>1</td><td>I,T</td></tr>
<tr><td>5G communication system</td><td>1</td><td>I,T</td></tr>
<tr><td>Blockchain applications</td><td>1</td><td>I,T</td></tr>
<tr><td>Virtual Reality</td><td>1</td><td>I,T</td></tr>
<tr><td>Sustainable engineering</td><td>1</td><td>I,T</td></tr>
<tr><td>Environmental Ethics</td><td>1</td><td>I,T</td></tr>
<tr><td>Life Long Learning Competencies</td><td>1</td><td>I,T</td></tr>
<tr><td>Case Studies</td><td>1</td><td>I,T</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Written Exam</td></tr>
</table>

Study and examination requirements	Assignments: All assignments need to be submitted on the due date. Otherwise, a penalty of 20% per day can be considered for each assignment. Policy on dishonesty: Students are expected to do their own work at all times. Any evidence of plagiarism or cheating will be treated as grounds for failure in the class. Grading The overall course grades will be assigned based on required standard or overall class distribution. The weights of the assignments and the examinations are: - 30% for participation, attendance, Quiz, HW, project, and presentation - 30% for midterm examination - 40% for final examination
Reading list	**Textbooks:** None

56. Radio Astrophysics (PH048IU)

Module designation	*The purpose of this course is to broaden students' knowledge in space science, to clearly understand how to use antennas in doing research in Astrophysics.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Assoc. Prof. Phan Bảo Ngọc
Language	English
Relation to curriculum	Elective
Teaching methods	Lecture, assignment, homework
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining themodule	Parallel course: Antenna and microwave engineering (EE105IU), Antenna and microwave engineering laboratory (EE124IU)

<table>
<tr>
<td>Module objectives/intended learning outcomes</td>
<td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Apply knowledge of antenna theory in designing radio antennas for science purposes</td></tr>
<tr><td>Skill</td><td>CLO2. Analyze signals and images of objects in space based on hands-on skills</td></tr>
<tr><td>Attitude</td><td>CLO3. Show abilities of further self-learning and longlife learning.</td></tr>
</table>
</td>
</tr>
<tr>
<td>Content</td>
<td>The description of the contents should clearly indicate the weighting of the content and the level.

Weight: lecture session (3 hours)

Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Chapter 1 An introduction to radio astrophysics</td><td>1</td><td>I, T</td></tr>
<tr><td>Chapter 2 Basic radiative transfer</td><td>2</td><td>T</td></tr>
<tr><td>Chapter 3 Blackbody radiation and radiation from an accelerated charge</td><td>2</td><td>T, U</td></tr>
<tr><td>Chapter 4 Radio telescopes, receivers, and interferometers</td><td>2</td><td>T, U</td></tr>
<tr><td>Chapter 5 Thermal continuum sources</td><td>2</td><td>T, U</td></tr>
<tr><td>Chapter 6 Non-thermal continuum sources</td><td>2</td><td>T, U</td></tr>
<tr><td>Chapter 7 Pulsars</td><td>2</td><td>T, U</td></tr>
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</table>

	Chapter 8 Spectral-line sources | 2 | T, U
Examination forms	Exam
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	[1] *Tools of Radio Astronomy*, T. L. Wilson, K. Rohlfs, S. Huttemeister, 5th Edition, Springer

57. Fundamental of Surveying (PH045IU)

Course designation	*This subject is related to some definitions of the Earth's shapes and coordinate systems and is also related to an introduction to measurement equipment, such as theodolite, level, etc. Moreover, it presents ways to conduct basic measurements and methods for estimating the accuracy of measured results. Besides, the course represents the procedures for creating coordinate and leveling traverses in creating topographic maps.*
Semester(s) in which the course is taught	1, 2
Person responsible for the course	Dr. Nguyễn Đình Hùng
Language	English
Relation to curriculum	Elective
Teaching methods	Lecture, lesson, practice, report.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 140 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 25, practice: 25 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 (2 theory + 1 practice) credits/5.08 ECTS
Required and recommended prerequisites for joining themodule	None

<table>
<tr>
<td>Course learning outcomes</td>
<td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1: Apply knowledge of the Earth’s shape, the Earth’s coordinate systems, and surveying methods to obtain high accuracy measurements.</td></tr>
<tr><td>Skill</td><td>CLO2: Practice basic measurements in surveying such as distance, angle, and leveling and traverse with appropriate surveying devices.</td></tr>
<tr><td>Attitude</td><td>CLO3. Show the impact of modern surveying devices and technical solutions for sustainable community planning and development.</td></tr>
</table>
</td>
</tr>
<tr>
<td>Content</td>
<td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Chapter 1: Introduction to Surveying</td><td>1</td><td>I, T</td></tr>
<tr><td>Chapter 2: Basic definitions in Surveying
Shape of the earth, coordinate systems</td><td>1</td><td>T</td></tr>
</table>
</td>
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</table>

	Chapter 3: Basic measurements in Surveying Principles for angle measurement, measurement equipment: theodolite, level Distance measurement Angle measurement: horizontal angle and vertical angle Leveling: differential leveling, benchmarks & turning points, trigonometric leveling	3	T, U
	Chapter 4: Errors in Surveying Error classification Accuracy estimation for results of direct measurement Accuracy estimation for results of indirect measurement	2	T, U
	Chapter 5: Azimuth, first and second geodetic problems	1	T, U
	Chapter 6: Traverse Coordinate traverse Leveling traverse	2	T, U
	Part B: Practical section Introduction to theodolite and level and how to use this equipment	1.25	T, U
	Measuring differential leveling	1.25	T, U
	Checking accuracy of theodolite	1.25	T, U
	Benchmarks and turning points	1.25	T, U
	Distance measurement	1.25	T, U
	Angle measurement Area measurement	1.25	T, U
	Trigonometric leveling	1.25	T, U
	Creating a simple traverse	1.25	U
Examination forms	Exam		
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.		

Reading list	**Textbooks:** [1] Tom Mastin Barry Kavanagh. (2014). *Surveying: Principles And Applications*, 9th Edition, Pearson India. **References:** *[2]* Barry Kavanagh, Diane Slattery. ().*Surveying with Construction Applications,* 8th Edition, Pearson India. [3] Wesley G. Crawford. (). *Construction Surveying and Layout: A Step-By-Step Field Engineering Methods Manual*, 3rd Edition