DS415 : Introduction to Engineering Management

Titular:
COL IMM (Land) Geert Letens (3 ECTS)
ECTS: 3
Contact hours: 24 hr(s) theory ; 6 hr(s) practice ;
Evaluation:
Daily work: amount written evaluations: 1
Daily work: amount oral evaluations: 0
Weight daily work: 10
Weight exam: 20
Type of exam: Oral,written

Content
Major technological challenges require a structured management approach. Therefore, this course provides an overview of the main Engineering Management Domains and illustrates their relevance for Defense. Further the course clarifies how technical activities in Defense can be managed in compliance with the Internal Control Systems Guidelines of Defense, following the basic principles of project and risk management.
1. Definition of Engineering Management
2. Core principles and techniques of Project Management
3. Case studies: life cycle costing, maintenance management, ISO 17025

Final competences
I. 1. Understanding of extensive subject matter in the field of Engineering and Military Sciences: DS
II. 1. Applying relevant and valid information to devise arguments, solve complex problems, formulate recommendations, and/or make decisions in the field of Engineering and Military Sciences: DS

Learning objectives
1. Understanding the various knowledge areas related to engineering management
2. Being able to assess the project management approach applied to a real life project

Required knowledge
CL317

Course material

Book (owned)
Slides (digital)
Articles

References

1. A guide to Engineering Management Body of Knowledge, American Society for Engineering Management, 5th edition.
2. Managing Successful projects with PRINCE II, Office of Government Commerce.
2. Farr, J, Systems Life Cycle Costing, 2011

Working methods

Ex Cathedra
Demonstration
Open Tasks

DS425 : Intelligent Decision Support Methods

Titular:
LCL (Air) Filip Van Utterbeeck (6 ECTS)
ECTS: 6
Contact hours: 30 hr(s) theory ; 30 hr(s) practice ;
Evaluation:
Daily work: amount written evaluations: 2
Daily work: amount oral evaluations: 0
Weight daily work: 20
Weight exam: 40
Type of exam: written

Content
1. Introduction
2. Uninformed Search
3. Informed Search
4. Adverserial Search
5. Constraint Satisfaction Problems
6. Markov Decision Processes
7. Reinforcement Learning
8. Classification
9. Clustering
10. Deep Learning

Final competences
I. 1. Understanding of extensive subject matter in the field of Engineering and Military Sciences: DS
II. 1. Applying relevant and valid information to devise arguments, solve complex problems, formulate recommendations, and/or make decisions in the field of Engineering and Military Sciences: DS
IV. 2. Thinking critically and acting scientifically: Elaborating a research question with a critical and evidence-based approach
IV. 3. Thinking critically and acting scientifically: Formulating a judgment on the grounds of critical thinking and an evidence-based approach

Learning objectives
The students obtain a general overview of the field of artificial intelligence and are able to explain and illustrate the different methods and algorithms. They are able to apply "classical" AI algorithms and design intelligent agents for a broad range of problems. They are able to identify the corrects methods for a given problem and can formulate

conclusions or recommendations based on their analysis of the results of the (computer-based) calculations and experiments they have both designed and implemented.

Required knowledge

ES121
ES123
ES211

Course material

Book (loan)
Slides (digital)
Software
Hardware (laptop)

References

Russel & Norvig: Artificial Intelligence, a modern approach
Both Matlab and Julia are used for the lab sessions.

Working methods

Ex Cathedra
Demonstration
Closed Tasks
Open Tasks

EN417 : Soil Mechanics

Titular:
LCL (Land) David Lecompte (5 ECTS)
ECTS: 5
Contact hours: hr(s) theory ; hr(s) practice ;
Evaluation:
Daily work: amount written evaluations:
Daily work: amount oral evaluations:
Weight daily work: 0
Weight exam: 50
Type of exam:

Content

Final competences

Learning objectives

Required knowledge

Course material

References

Working methods

EN427 : Construction Engineering Design

Titular:
LCL (Land) David Lecompte (5 ECTS)
ECTS: 5
Contact hours: hr(s) theory ; hr(s) practice ;
Evaluation:
Daily work: amount written evaluations:
Daily work: amount oral evaluations:
Weight daily work: 0
Weight exam: 50
Type of exam:

Content

Final competences

Learning objectives

Required knowledge

Course material

References

Working methods

EN428 : Analysis of Constructions

Titular:
LCL (Land) David Lecompte (5 ECTS)
ECTS: 5
Contact hours: hr(s) theory ; hr(s) practice ;
Evaluation:
Daily work: amount written evaluations:
Daily work: amount oral evaluations:
Weight daily work: 0
Weight exam: 50
Type of exam:

Content

Final competences

Learning objectives

Required knowledge

Course material

References

Working methods

EN428 : Analyse des structures

Titulaire:
LCL (Land) David Lecompte (5 ECTS)
ECTS: 5
Heures de contact: hr(s) de théorie ; hr(s) pratique ;
Evaluation:
Travail journalier : nombre d'évaluations écrites:
Travail journalier : nombre d'évaluations orales:
Coefficient de pondération pour le travail journalier: 0
Coefficient de pondération pour l'examen: 50
Type d'examen:

Contenu

Acquis d'apprentissage

Objectifs

Connaissances préalables exigées

Matériel de cours

Références

Modes de travail

EN428 : Analyse van constructies, inleiding stabiliteit

Titularis:
LCL (Land) David Lecompte (5 ECTS)
ECTS: 5
Contacturen: u theorie ; u praktijk ;
Evaluatie:
Dagelijks werk: aantal schriftelijke evaluaties:
Dagelijks werk: aantal mondelinge evaluaties:
Gewichtscoëfficiënt dagelijks werk: 0
Gewichtscoëfficiënt examen: 50
Examenvorm:

Inhoud

Eindcompetenties

Leerdoelstellingen

Vereiste voorkennis

Cursusmateriaal

Referenties

Werkvormen

EP414 : Electrical Power Systems

Titular:
LCL (Land) Maarten Vergote (6 ECTS)
ECTS: 6
Contact hours: 37 hr(s) theory ; 25 hr(s) practice ;
Evaluation:
Daily work: amount written evaluations: 0
Daily work: amount oral evaluations: 2
Weight daily work: 20
Weight exam: 40
Type of exam: Oral,written

Content
Basic Laws
- Circuit laws - Faraday, Laplace, Maxwell-Ampère - Active and reactive power, power balance, power factor - Phasors
General overview of electrical power systems
- Introduction: some numbers about electricity production
- General power system properties
- Electric power generation : Thermal power plants
- Nuclear physics in electric power generation : Nuclear Power Plants
- Renewable electricity production (hydropower - wind - solar)
- Energy storage.

Electric safety
- Earthing - Hazards - Switching devices - Over-current protection - Protection against leakage currents

Electrical power systems components
- Tansformers
- Three phase networks
- General overview of electrical machines (DC, induction, synchronous)
- Synchronous machines (alternator, motor)

Topical subjects presented in flipped classroom (electricity grid load - generation - interconnections - trading, modern electric motors / actuators, electric and more-electric ships, aircrafts and ground vehicles, ...)

Final competences
I. 2. Understanding of extensive subject matter in the field of Engineering and Military Sciences: EP
II. 2. Applying relevant and valid information to devise arguments, solve complex problems, formulate recommendations, and/or make decisions in the field of Engineering and Military Sciences: EP

III. 2. Applying language and communication skills efficiently: Communicating orally his/her conclusions, knowledge, and the rationale underpinning these
VI. 2. Acting autonomously: Gathering and interpreting relevant information from the different disciplines to devise a sound judgment, solve a complex problem, and/or decide
VI. 3. Acting autonomously: Practicing an attitude of lifelong learning

Learning objectives

At the end of the course, students are expected to be able to:
- Distinguish the dangers of electricity and use adequate protection means;
- Explain, criticize and discuss issues related to production (fossil, nuclear and renewable), transport, distribution, storage, transformation and consumption (including modern electric drives) of electric energy ;
- Select an appropriate mathematical model and use it to predict the behaviour of power system components ;
- Taking into account security measures and components limitations, design an experimental setup and use it to measure the quantities needed to characterize power system components,
- Assess the accuracy of the mathematical models used by comparing their predictions with measurements.

Required knowledge

ES212
ES213
ES222
ES223
ES311
ES322
ES323

Course material

Notes (printed)
Slides (digital)
Book (loan)

References

Loan: Electrical Power System Essentials, P. Schavemaker, L. van der Sluis, ISBN: 978-1-118-80347-9
An introduction to electrical machines and transformers (Second edition), George McPherson, Robert D. Laramore, ISBN: 978-0-471-63529-1

Working methods

- Ex Cathedra
- Closed Tasks
- Open Tasks

LC416 : Leadership

Titular:
LCL MAB (Land) Hans De Smet (3 ECTS)
ECTS: 3
Contact hours: 22 hr(s) theory ; 2 hr(s) practice ; 6 hr(s) visit
Evaluation:
Daily work: amount written evaluations: 1
Daily work: amount oral evaluations: 0
Weight daily work: 10
Weight exam: 20
Type of exam: Oral

Content
The course LS416 develops the academic basis relative to different leadership aspects. It focuses on the personality of the leader (BE, KNOW, DO), the situation (mainly how a group works) and the mutual influences. These aspects are developed through interactive classes.

Final competences
I. 3. Understanding of extensive subject matter in the field of Engineering and Military Sciences: LC
II. 1. Applying relevant and valid information to devise arguments, solve complex problems, formulate recommendations, and/or make decisions in the field of Engineering and Military Sciences: DS
III. 1. Applying language and communication skills efficiently: Communicating in writing his/her conclusions, knowledge, and the rationale underpinning these
III. 2. Applying language and communication skills efficiently: Communicating orally his/her conclusions, knowledge, and the rationale underpinning these
IV. 1. Thinking critically and acting scientifically: Gathering information with a critical and evidence-based approach
IV. 3. Thinking critically and acting scientifically: Formulating a judgment on the grounds of critical thinking and an evidence-based approach

Learning objectives
At the end of the course LS416, the student possesses the competencies required to :
- explain and illustrate the basic leadership styles;
- explain and illustrate the basic notions of leadership;
- explain the Vision of Leadership at Defence;
- explain and illustrate what effective leaders must be (Vision);
- explain and illustrate what effective leaders must know (Vision);

- explain and illustrate what effective leaders must do (Vision);
- explain and illustrate the main monofactorial and bifactorial models;
- apply the decision making model of Maier;
- apply the steps of the decision making process;
- explain and illustrate the main motivation theories;
- explain and illustrate the notion of social cohesion;
- explain and illustrate the notion of social influence;
- explain and illustrate the principles of interpersonal communication;
- explain and illustrate the principles of feedback;
- explain and illustrate the notion of individual and group resilience;
- analyse a personality based on the leadership models and formulate a judgement on his/her leadership style;

Required knowledge

CL116
BS227

Course material

Book (owned)
Slides (digital)
Notes (digital)
Articles

References

The vision of leadership at Defence

Working methods

Ex Cathedra
Teaching Conversation
Class Discussion
Closed Tasks
Open Tasks

SE412 : Tactical Military Sensors

Titular:
LCL (Air) Marijke Vandewal (7 ECTS)
ECTS: 7
Contact hours: 48 hr(s) theory ; 20 hr(s) practice ; 4 hr(s) visit
Evaluation:
Daily work: amount written evaluations: 2
Daily work: amount oral evaluations: 0
Weight daily work: 23
Weight exam: 47
Type of exam: written

Content
This course starts with a general introduction on military remote sensing. Based on the spectral domain where the sensors are operating they will be subdivided in electro-optical/infrared (EO/IR) sensors and radar systems. This subdivision is the basis for the general structure of the course which will consist of 3 parts: (1) passive EO/IR sensors, (2) active EO/IR sensors, (3) radar. For each part, the information is structured in the same way. First the relevant phenomenology is described, explaining the proper emission of the sources and targets, their reflection properties, and the transmission behavior of the atmosphere. Then the description of the sensor itself follows including hardware, signal/image processing and measurement principles. Combining all that information leads to an understanding of the sensor performance and limitations, and how countermeasures could work. Directed Energy Weapons are also discussed here. A wrap-up is foreseen for each part and each sensor, describing military applications and future trends.

Final competences
I. 4. Understanding of extensive subject matter in the field of Engineering and Military Sciences: SE
II. 4. Applying relevant and valid information to devise arguments, solve complex problems, formulate recommendations, and/or make decisions in the field of Engineering and Military Sciences: SE
IV. 3. Thinking critically and acting scientifically: Formulating a judgment on the grounds of critical thinking and an evidence-based approach

Learning objectives
After completion of the course, the student is expected to be able to:

- Clarify and illustrate the main components of the discussed military sensors and DEW
- Interprete and evaluate technical specifications linked to these systems
- Link the sensor and weapon performances to these technical specifications and to the limits of the main system components
- Use international norms and standards to assess sensor performance
- Select the applications made possible by the use of the sensors
- Apply the acquired knowledge to analyse existing remote sensing systems and DEW

Required knowledge

ES211
ES213
ES222
WS225
ES311
TN325

Course material

Slides (printed)
Slides (digital)
Notes (printed)
Notes (digital)
Book (loan)
Articles

References

Working methods

Ex Cathedra
Demonstration
Teaching Conversation
Closed Tasks

SE422 : Digital Technology for Sensors and Weapons

Titular:
CDT (Land) Koen Boeckx (5 ECTS)
ECTS: 5
Contact hours: 36 hr(s) theory ; 12 hr(s) practice ;
Evaluation:
Daily work: amount written evaluations: 1
Daily work: amount oral evaluations: 0
Weight daily work: 17
Weight exam: 33
Type of exam: Oral

Content
The course material will cover :
- Integrated circuit technology (CMOS/BJT/BiCMOS)
- Transistor modelling
- Current and voltage reference circuits
- Basic building blocks (amplifiers, buffers, differential amplifier)
- Comparator Design
- OPAMP Design (Miller OPAMP)
- Stabilization techniques
- Noise in electronic circuits
- Sensor integration
- Integrated sensor types
- Sensor characteristics
- Sensor interfacing
- MEMS integration
- Read-out circuit design
- Readout modes
- Optical camera design and implications
- Computer Architecture

Final competences
I. 4. Understanding of extensive subject matter in the field of Engineering and Military Sciences: SE
II. 4. Applying relevant and valid information to devise arguments, solve complex problems, formulate recommendations, and/or make decisions in the field of Engineering and Military Sciences: SE
IV. 1. Thinking critically and acting scientifically: Gathering information with a critical and evidence-based approach

IV. 2. Thinking critically and acting scientifically: Elaborating a research question with a critical and evidence-based approach
IV. 3. Thinking critically and acting scientifically: Formulating a judgment on the grounds of critical thinking and an evidence-based approach
IV. 4. Thinking critically and acting scientifically: Deciding on the grounds of critical thinking and an evidence-based approach

Learning objectives

After finishing the course the student will be able to :
Characterize using mathematical models the operation of integrated circuits and verify their performance against the specification (Understanding of extensive subject matter in the field of Engineering and Military Sciences).
Read, evaluate and understand scientific papers on electronic circuit theory and sensor systems, synthesis conclusions and present as well defend these conclusions in a written paper (Applying relevant and valid information to devise arguments, solve complex problems, formulate recommendations, and/or make decisions, as well as thinking critically and acting scientifically)

Required knowledge

ES222

Course material

Book (owned)
Software
Slides (printed)

References

Working methods

Ex Cathedra
Closed Tasks
Open Tasks

SE426 : Military Satellite based Positioning

Titular:
GHL (Civ) Alain Muls (3 ECTS)
ECTS: 3
Contact hours: 20 hr(s) theory ; 10 hr(s) practice ;
Evaluation:
Daily work: amount written evaluations: 0
Daily work: amount oral evaluations: 1
Weight daily work: 10
Weight exam: 20
Type of exam: Oral

Content
- Satellite geodesy made easy
- Brief review of satellite geodesy
- The legacy Global Positioning System
- The European Galileo system
- Overview of modern GNSS system
- Solving the navigation problem
- Augmentation systems
- Open source GNSS processing

Final competences

Learning objectives
- understand
– the basic concepts of GNSS systems
– the functioning of the legacy GPS system from satellite to receiver
– the modernised GNSS signals and navigation messages
– the European Galileo system
– the processing of GNSS observations
– the added values of augmentation systems
- be able to use open source GNSS processing software

Required knowledge
SE115

Course material
Slides (printed)
Slides (digital)
Book (loan)

References

Working methods

Ex Cathedra
Open Tasks

TN423 : Networks and Security Awareness

Titular:
MAJ (Air) Thibault Debatty (7 ECTS)
ECTS: 7
Contact hours: 48 hr(s) theory ; 16 hr(s) practice ;
Evaluation:
Daily work: amount written evaluations: 2
Daily work: amount oral evaluations: 0
Weight daily work: 23
Weight exam: 47
Type of exam: Oral

Content
* Introduction to networking and OSI model
* Protocols (Layer 1 -> Layer 7)
* Introduction to routing
* security : introduction
* security threats
* security controls: filters, crypto
* detection of security incidents
* OSINT

Final competences
I. 5. Understanding of extensive subject matter in the field of Engineering and Military Sciences: TN
II. 5. Applying relevant and valid information to devise arguments, solve complex problems, formulate recommendations, and/or make decisions in the field of Engineering and Military Sciences: TN

Learning objectives
* explain the interaction between network protocols
* explain the role and working of network protocols
* analyze a new protocol and compare it with seen technologies
* explain the different security concepts and threats
* explain which security controls can protect (or not) agains threats
* explain how we can detect security incidents

Required knowledge

Course material
Slides (digital)
Notes (digital)

References

Working methods

Ex Cathedra
Closed Tasks
Demonstration
Teaching Conversation

TP413 : Cabin Environment of Military Platforms

Titular:
LCL (Land) Bart Janssens (3 ECTS)
ECTS: 3
Contact hours: 15 hr(s) theory ; 18 hr(s) practice ;
Evaluation:
Daily work: amount written evaluations: 1
Daily work: amount oral evaluations: 0
Weight daily work: 10
Weight exam: 20
Type of exam: Oral

Content
1. Comfort requirements
2. Thermodynamics of moist air
3. Heat transfer
4. Cabin energy balance
5. Ventilation
6. Air quality and filtration

Final competences
I. 6. Understanding of extensive subject matter in the field of Engineering and Military Sciences: TP
II. 6. Applying relevant and valid information to devise arguments, solve complex problems, formulate recommendations, and/or make decisions in the field of Engineering and Military Sciences: TP

Learning objectives
- Define and estimate properties of moist air
- Model the static and (simplified) dynamic thermal heat transfer
- Solve an energy balance in the presence of different modes of heat transfer
- Being able to calculate the necessary ventilation needs in order to obtain thermal comfort conditions
- estimate friction losses in ventilation systems
- Analyze a complete vehicle ventilation system

Required knowledge
ES312

Course material

Slides (digital)
Notes (digital)

References

ASHRAE fundamentals handbook

Working methods

Ex Cathedra
Demonstration
Closed Tasks
Open Tasks

TP424 : Ballistic Impact and Protection: Fundamentals

Titular:
LCL IMM (Land) Frederik Coghe (3 ECTS)
ECTS: 3
Contact hours: 16 hr(s) theory ; 14 hr(s) practice ;
Evaluation:
Daily work: amount written evaluations: 1
Daily work: amount oral evaluations: 0
Weight daily work: 10
Weight exam: 20
Type of exam: Oral

Content
The course TP424 addresses the field of terminal ballistics from both a practical and a theoretical point of view. This includes an overview of the different ballistic threats present on the modern battlefield, modelling approaches to evaluate the effects of these threats, next to introducing basic protective schemes based on the aforementioned models.
The level of ambition of this course is not aimed at the development of new weapon systems or ballistic protection systems but more at acquiring the skills to evaluate the feasibility of weapon systems or ballistic protection concepts from a technical point of view.
Based on "first principle" approaches this course will provide the necessary tools to validate weapon system and ballistic protection concepts. A number of modelling approaches in this field will be investigated in more detail both by desktop calculations and/or simulations using finite element software.

Final competences
I. 6. Understanding of extensive subject matter in the field of Engineering and Military Sciences: TP
II. 6. Applying relevant and valid information to devise arguments, solve complex problems, formulate recommendations, and/or make decisions in the field of Engineering and Military Sciences: TP

Learning objectives
After finishing this course, the student should have obtained the necessary skills to:
- Give a reasoned vision on the technology used for weapon systems and ballistic protection for military systems;

- Choose and apply a suitable method and/or model to solve a problem in this field, after critically assessing the actual problem to solve;
- Link the contents of this course to the content of the other courses in the field of ballistics regarding threats and ballistic protection.

Required knowledge

ES114
ES125
ES211
ES214
WS225
ES321
WA411

Course material

Notes (digital)
Slides (digital)
Book (loan)

References

Rosenberg & Dekel, "Terminal Ballistics", 2012, https://www.springer.com/gp/book/9783642445125.

Working methods

Ex Cathedra
Closed Tasks
Open Tasks

WA411 : Design Principles and Evaluation of Armament and Ammunition

Titular:
LCL IMM (Land) Frederik Coghe (8 ECTS)
ECTS: 8
Contact hours: 46 hr(s) theory ; 30 hr(s) practice ; 8 hr(s) visit
Evaluation:

Daily work: amount written evaluations: 2
Daily work: amount oral evaluations: 0
Weight daily work: 26
Weight exam: 54
Type of exam: Oral

Content

The course WA411 limits itself to the classical gun systems, i.e. excluding rockets, missiles and electrical systems. It covers small, medium and large calibre gun systems, next to kinetic energy non-lethal weapons.
The level of ambition of this course is not aimed at the development of new weapon systems but more at acquiring the skills to follow-up weapon system projects and evaluate their feasibility from a technical point of view.
Based on "first principle" approaches this course will provide the necessary tools to validate weapon systems projects and/or concepts.
A number of weapon system concepts will be investigated in more detail both by desktop calculations and laboratory sessions in the Laboratory of the Department ABAL.
The course will be concluded by a one-day visit to the relevant Belgian industry.

Final competences

I. 7. Understanding of extensive subject matter in the field of Engineering and Military Sciences: WS
II. 7. Applying relevant and valid information to devise arguments, solve complex problems, formulate recommendations, and/or make decisions in the field of Engineering and Military Sciences: WS
III. 1. Applying language and communication skills efficiently: Communicating in writing his/her conclusions, knowledge, and the rationale underpinning these
III. 2. Applying language and communication skills efficiently: Communicating orally his/her conclusions, knowledge, and the rationale underpinning these

Learning objectives

After finishing this course, the student should have obtained the necessary skills to:

- Give a reasoned vision on the technology used for armament regarding regular gun systems ;
- Choose and apply a suitable method and/or model to solve a problem in this field, after critically assessing the actual problem to solve ;
- Link the contents of this course to the content of the other courses in the field of ballistics regarding regular gun systems.

Required knowledge

ES114
ES125
ES211
ES321
WS225
WA326

Course material

Notes (digital)
Slides (digital)

References

N/A

Working methods

Ex Cathedra
Demonstration
Closed Tasks
Open Tasks

WA421 : Guided Weapons

Titular:
COL (Land) Johan Gallant (6 ECTS)
ECTS: 6
Contact hours: 28 hr(s) theory ; 38 hr(s) practice ;
Evaluation:
Daily work: amount written evaluations: 2
Daily work: amount oral evaluations: 0
Weight daily work: 20
Weight exam: 40
Type of exam: Oral

Content

In the first part of the course (2 Hr theory, 20 Hr practical work) different practical aspects of rocket propulsion are addressed in the form of laboratory sessions: processing of extruded rocket propellant, burning rate law determination in closed vessel, life firing tests, study of sensitivity to mechanical and electrical stimuli and determination of the heat of explosion, and safety aspects related to deflagration-to-detonation transition and the insensitive munition concept.

In the second part of the course (26 Hr theory, 18 Hr practical work), the four main components of a guided weapon are discussed : guidance, control, propulsion and warhead. The emphasis is on guidance and control, where mathematical models are developed. The trajectory models (2DOF to 6DOF models), combined with the guidance models, lead to launch and intercept envelopes and the definition of avoidance techniques. The chapter on guidance methods presents technical solutions for guidance problems, based on available sensors and guidance laws. In the chapter on control methods, the technical solutions for the control problem are compared. The chapters on propulsion and warhead are limited to comments on the selection of engines and warhead as a function of the requirements.

Final competences

I. 7. Understanding of extensive subject matter in the field of Engineering and Military Sciences: WS
II. 7. Applying relevant and valid information to devise arguments, solve complex problems, formulate recommendations, and/or make decisions in the field of Engineering and Military Sciences: WS
IV. 4. Thinking critically and acting scientifically: Deciding on the grounds of critical thinking and an evidence-based approach

V. 1. Working with people as an individual or in a group: Adapting to individual human behavior and group dynamics
VI. 2. Acting autonomously: Gathering and interpreting relevant information from the different disciplines to devise a sound judgment, solve a complex problem, and/or decide

Learning objectives

By the end of the course, students will be able to:
- evaluate the performance of a propulsion system,
- explain the working principles of guided weapons,
- compare the guidance, control and propulsion methods,
- see the connection between the different functions of tactical guided weapons,
- evaluate the performance of a guided weapon,
- create simulation models of the guidance, control and propulsion functions.

Required knowledge

WS225
WA314
ES322
WA326
SE412

Course material

Notes (printed)
Software
Hardware (laptop)
Slides (printed)
Notes (digital)
Slides (digital)

References

P. Zarchan, Tactical and Strategic Missile Guidance, Ed. 6, AIAA, 2012
E.L. Fleeman, Tactical Missile Design, Ed. 2, AIAA, 2006
G.M. Siouris, Missile Guidance and Control Systems, Springer, 2004
A. Davenas, Solid Rocket Propulsion Technology, Pergamon Press, 1993
N. Kubota, Propellants and Explosives, Thermochemical Aspects of Combustion, Wiley-VCH, 2002.
G.P. Sutton and O. Biblarz, Rocket Propulsion Elements, John Wiley & Sons Inc., 7th Ed., 2001
Y.M. Timnat, Chemical Propulsion, Academic Press, 1987
J. Carleone, Tactical Missile Warheads, Volume 155, AIAA, 1993

Working methods

Ex Cathedra
Demonstration
Open Tasks