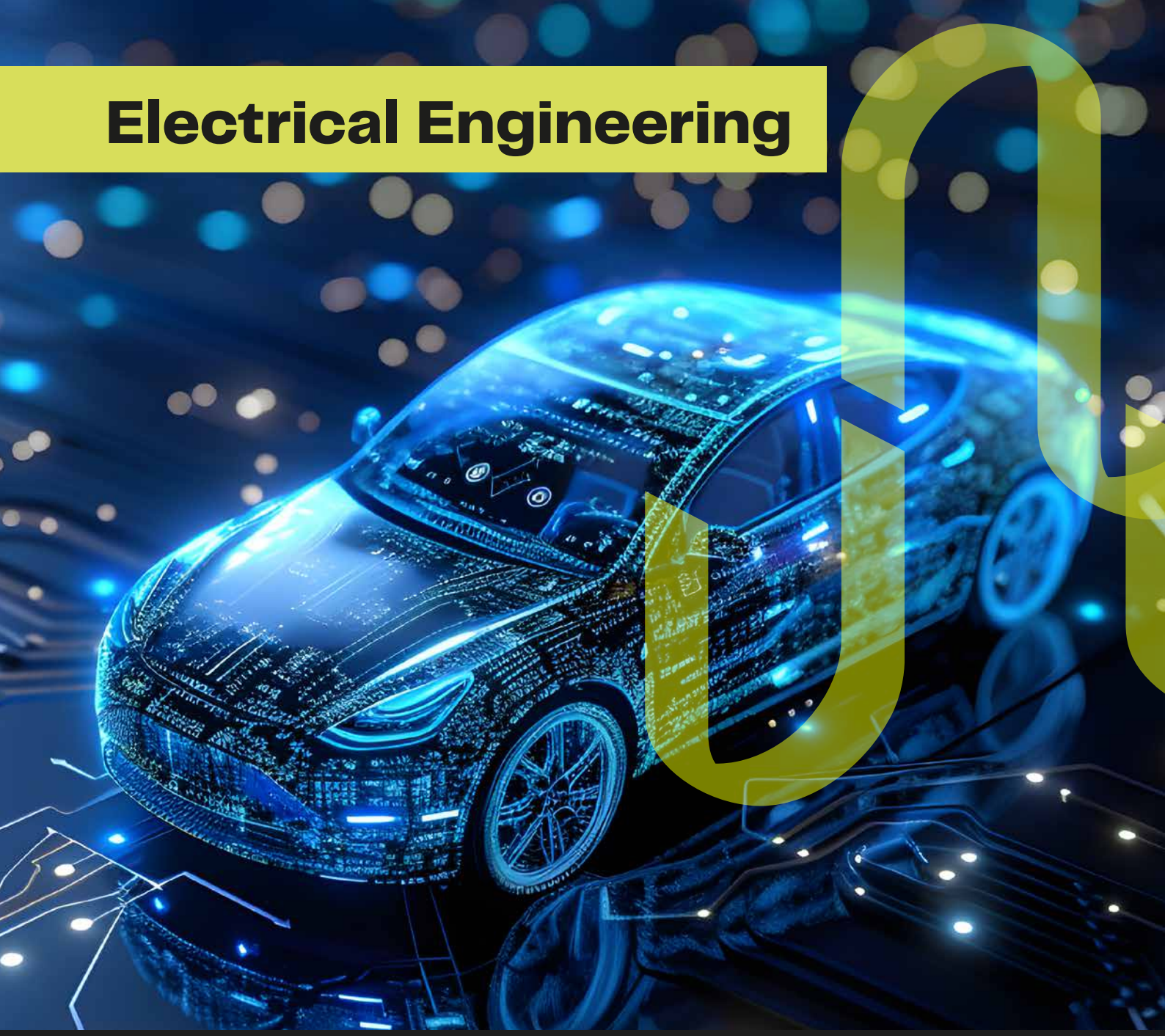
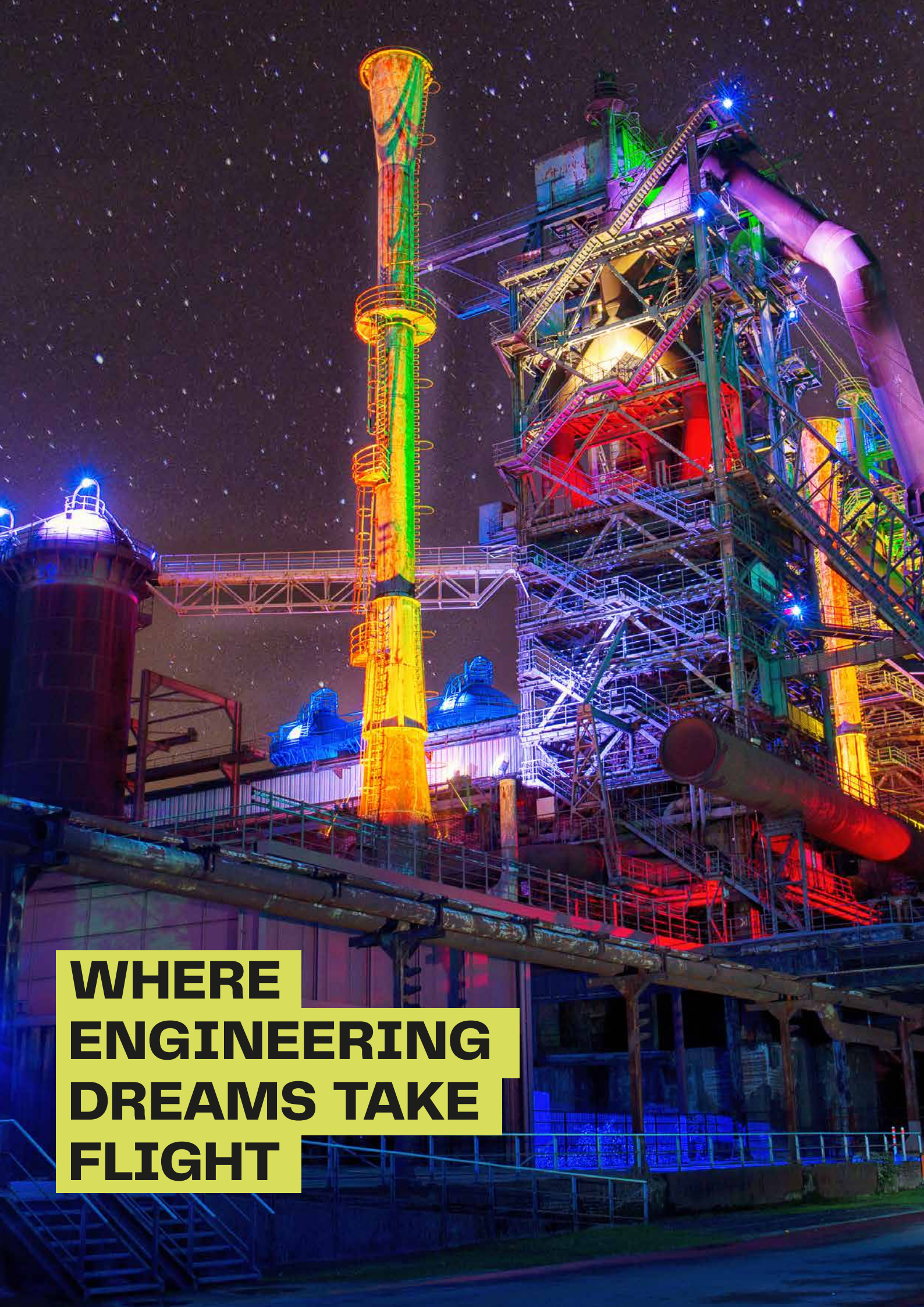
Electrical Engineering



MODULE MANUAL

SUMMER SEMESTER 2025



WHERE ENGINEERING DREAMS TAKE FLIGHT

Discover the Heartbeat of German Industry

Welcome to the 30 ECTS Program for electrical engineers in English language at Bochum University of Applied Sciences, Fachhochschule Dortmund – University of Applied Sciences and Arts, and the Westphalian University of Applied Sciences. The program is open to international undergraduate students, offering an insight into the expertise in electrical engineering on a bachelor level at the three participating universities. It grants an overall unique international experience.

Overview

Preliminary Remarks

How to study at three reputable German universities of applied sciences?

When you are a student of the 30 ECTS Program for international incomings, you get the opportunity to study not at one but at three reputable German universities of applied sciences. While you enroll at one of the three universities as an incoming international student, it is necessary to register as a cross-registered student as well to be able to attend the modules at all three universities and thus benefitting from the broader selection of elective modules in English. You will receive detailed instructions on how to enroll as a secondary student at the other two universities. The process is fully digital and simple. No worries. Enrolling as a cross-registered student at the other two universities is free of charge for you.

Exams

Your exam achievements from the other two universities will be recognized by your host university as all three are part of the Higher Education Alliance Ruhr. You will receive detailed guidance on the enrolling process once you have enrolled at your guest university.

Module manual and workload

To prepare your learning agreement, the present module manual gives you the entire choice of courses from the 30 ECTS Program of all three alliance universities. Please be aware that the workload and therefore the number of ECTS for a module might vary according to the requirement of your host university. Please note that a course can only take place if enough students take part.

If you have questions concerning the number of ECTS, please do not hesitate to contact us:

→ study@hochschulallianz.ruhr

Details can be discussed individually.

Please be aware that all information is subject to possible changes.

Program locations

The courses of the 30 ECTS Program take place at the university campuses in Dortmund and in Bochum as well as at the two locations of the Westphalian University of Applied Sciences in Gelsenkirchen and in Bocholt. All modules in this manual are in-class lectures requiring a physical presence of the students at the respective campus. Depending on your choice of modules, you will be required to commute between the universities accordingly. Please become familiar with the locations of Fachhochschule Dortmund - University of Applied Sciences and Arts, Bochum University of Applied Sciences, and the campuses of the Westphalian University of Applied Sciences in Gelsenkirchen and in Bocholt. We will also give you more information on the different locations in an onboarding session.

Please make sure to calculate enough time between the seminars on the different campuses. (The commute with public transportation can vary from one hour between the campuses in Bochum and Dortmund up to two and a half hours to Bocholt from Bochum or Dortmund and vice versa). Your semester ticket allows you to shuttle at no extra costs and you have a sustainable journey between the different cities.

Exploring public transportation as an international student

Mobility in Metropolitan Area Ruhr

HIGHER EDUCATION ALLIANCE RUHR

What is the Higher Education Alliance Ruhr?

The 30 ECTS Program for international exchange students is an offer of the Higher Education Alliance Ruhr. The Higher Education Alliance Ruhr is a consortium of Universities of Applied Sciences in the Ruhr area consisting of Bochum University of Applied Sciences, Fachhochschule Dortmund - University of Applied Sciences and Arts, and the Westphalian University of Applied Sciences. They cooperate in various fields, seeking to strengthen their international visibility, their networking and exchange opportunities as well as the mobility of their students, lecturers, researchers, and staff. The goal of the university alliance is to promote cross-border, intercultural exchange as well as international competences to prepare students for an international career.

The Higher Education Alliance Ruhr enables students to choose from a broader range of offers, to set an individual focus in their studies and to look beyond their own horizons.

Contact information

Program coordinator:

For further information about our 30 ECTS program, please contact our program coordinator. Feel free to schedule a video call.

study@hochschulallianz.ruhr

APPLIED NETWORK SECURITY

Westphalian University of Applied Sciences, Campus: Gelsenkirchen

ECTS	Workload	Study Semester	Duration	Frequency
6	180 h		One semester	
Courses		**Attendence Time**	**Self-Study**	**Group Size**
2 h lectures | 2 h practical work (i.e. labs) (per semester week)		56 h	124 h	

Learning outcomes/Objectives

Students understand various attack vectors and corresponding protection mechanisms in modern networks. Specifically, students have knowledge and understanding of the following topics.

- Understanding of basic concepts and principles of network security, including threats, attack methods and protection options.
- Knowledge of common network attacks such as Distributed Denial-of-Service (DDoS), Man-in-the-Middle (MitM), spoofing, and others.
- Understanding of security protocols and technologies for mitigating attack vectors and reducing attack surfaces.
- Assessment of IT security risks in networks and of various attack vectors

Contents

Basics

- Network architectures and concepts: TCP/IP and ISO/OSI reference model, common protocols, network architectures.
- Network security: Introduction, threats, challenges.
- Analysis of network traffic: Capturing and reading network traffic, common tools and data formats for reading, advantages and limitations of different approaches

- Security at the Internet and network access layer
- Attacks at MAC and IP level: ARP poisoning, MAC spoofing, ICMP flooding, network scanners.
- Security of wireless networks: encryption (WPA3), MAC address filtering and hiding of SSIDs, Evil Twin attacks, man-in-the-middle attacks

Security at the transport level

- Attacks on TCP and UDP: port scanning, TCP session hijacking, UDP flooding and reflection attacks.
- Protocols for encryption: Transport Layer Security (TLS) and Datagram Transport Layer Security (DTLS)

Security at the application level

- Security of web applications: Cross-site request forgery (CSRF) and cross-site scripting (XSS), HTTP security mechanisms (e.g. content security policies), command and SQL injections.
- DNS security: DNS spoofing, DNSSEC, DNS tunneling, DNS amplification attacks
- Email security: SPAM detection, email encryption, phishing

Teaching Methods

Lecture, Practical training

Lecturer

Prof. Dr. Tobias Urban

Additional Information:

The current literature, the forms of examination as well as the requirements for the award of credits will be announced by the lecturer at the beginning of the module.

ENGLISH FOR SCIENCE AND TECHNOLOGY

Westphalian University of Applied Sciences, The Language Center, Campus: Gelsenkirchen

ECTS	Workload	Study Semester	Duration	Frequency
5	150 h		1 Semester	Every semester
Courses		**Attendence Time**	**Self-Study**	**Group Size**
		60 h	90 h	20 - 30 students

Learning outcomes/Objectives

Upon completion students will be able to engage successfully in occupation-oriented and academic discourse settings using appropriate English while taking into account (inter)cultural elements.

Contents

The course covers technical English language requirements with respect to engineering and scientific topics and professional communication, taking into account technical texts, documents and documentation. Methodological and content-related aspects include

- understanding technical texts and documents,
- report writing,
- presenting diagrams,
- presentations,
- formulae and mathematical expressions,
- product and process descriptions,
- listening exercises on science and technology

Teaching Methods

Scheduled on-site teaching using a wide array of media. The classroom teaching is complemented by guided and independent study periods which are supported by a wide range of digital learning resources offered by the Language Centre (see below).

Participation Requirements (Prerequisites/ Eligibility)	**Requirements for award of ECTS points**
Formal: none In terms of content: advanced English skills as stipulated by the German University and Higher Education entrance regulations If needed: attendance of the “English Support Programme (ESP)” offered by the Language Centre	A minimum of 50% (50 points out of 100)
Forms of examination (Type)	**Requirements for taking the exam**
Written exam (120 min)	None
Module Coordinator	**Lecturers**
The Language Centre	Julia Brassat, MA; Dr. Thorsten Winkelräth et al. (The Language Centre)

Additional Information:

Resources → p. 21

GERMAN AS A FOREIGN LANGUAGE: BASIC COURSE

Westphalian University of Applied Sciences, Campus: Gelsenkirchen

ECTS	Workload	Study Semester	Duration	Frequency
5	150 h		One semester	Every semester
Courses		**Attendence Time**	**Self-Study**	**Group Size**
		60 h	90 h	Max 30 students

Learning outcomes/Objectives

Communicative and cultural competence in the German language on a basic level.

Contents

Introduction to the basic structures of the German language:
The course offers an introduction to German as a foreign language for beginners. It will cover basic vocabulary and grammar needed in everyday situations and academic settings. Cultural aspects related to the respective topics will be addressed throughout the course. Following a blended-learning approach, the course will be completed by digital content.

Teaching Methods

Seminar and others

Participation Requirements (Prerequisites/ Eligibility)	**Requirements for award of ECTS points**
None	At least 50% (50/100 pts)
Forms of examination (Type)	**Requirements for taking the exam**
Written exam (120 min); no aids (e.g., dictionaries) permitted	None
Module Coordinator	**Lecturer**
The Language Centre	Julia Brassat, Dr. Tobias Budke et al. (Language Centre – Sprachenzentrum)

Additional Information:

The course will include the systematic use of classic and interactive media in the classroom and in the Language Centre's multi-media lab.

INTRODUCTION TO ROBOTICS

Westphalian University of Applied Sciences, Campus: Gelsenkirchen

ECTS	Workload	Study Semester	Duration	Frequency
6	180 h	4th semester / Bachelor	One semester	Summer semester

Courses	Attendence Time	Self-Study	Group Size
2 h lecture | 3 h practical work and exercise session (lab time) (per semester week)	70 h	110 h	

Learning outcomes/Objectives

Students learn the basics, components and terminology of industrial robots and collaborative robots. They learn programming concepts and methods and can use these effectively and in a structured manner when developing their own control programs. They are familiar with the dangers and challenges of using industrial robots and understand the importance of complying with regulations. In addition to the programming methodology, students learn how to use libraries of the robot framework ROS2 (Robot Operation System).

Contents

- Fundamentals of industrial robotics / manipulator technology, collaborative robots
- Conceptualization and components
- Description of a robot position
- Transformation between robot and world coordinates
- Kinematic (Denavit-Hartenberg-Transformation)
- Inverse kinematic (Mathematical, Jacobian matrix, Neural Networks)
- Robot programming
- Robot framework ROS2
- Motion type and interpolation
- Operating system: Linux + ROS2; teaching languages are C / C++, Python, ipython notebooks
- Robots for lab exercises: Franka Arm, Kuka

Teaching Methods

Lecture, Practical work and exercise sessions (lab time)

Lecturer

Prof. Dr. Hartmut Surmann

Additional Information:

The current literature, the forms of examination as well as the requirements for the award of credits will be announced by the lecturer at the beginning of the module.

LASERS: BASIC PRINCIPLES AND APPLICATIONS

Westphalian University of Applied Sciences, Campus: Bocholt

ECTS	Workload	Study Semester	Duration	Frequency
6	180 h	4th semester / Bachelor	One semester	

Courses	Attendence Time	Self-Study	Group Size
Lecture Tutorium Practical work	30 h 15 h 15 h	30 h 45 h 45 h	Practical work: maximum of 8 students

Learning outcomes/Objectives

The students understand the physical principles of laser technology and are familiar with various types of lasers and their properties. They comprehend laser specifications and are capable of developing them. They understand system solutions for problems in the field of laser applications and can develop optical setups for specific applications.They are able to work in a team and to present and discuss their results.

Contents

- Light-Matter Interaction
- Formation of Laser Beams
- Properties of Laser Radiation
- Types of Lasers
- Ultrashort Laser Pulses

Applications:
- Metrology (e.g. Holography, LIDAR, Trace Gas Analysis, Frequency Combs, Optical Coherence Tomography)
- Material Processing (e.g. Corneal Surgery, Laser Cutting, Laser Marking)

Teaching Methods

Lecture, tutorium, practical work

Participation Requirements (Prerequisites/ Eligibility)	Requirements for award of ECTS points
None	

Forms of examination (Type)	Requirements for taking the exam
Oral examination	None

Use of the module

Mandatory elective course for the degree program „Elektrotechnik-Automation / Elektrotechnik Smart Communications“

Importance of the grade of the module to the final score

See examination regulations

Module Coordinator	Lecturer
Prof. Dr. Susanne Frey	Prof. Dr. Susanne Frey

Additional Information:

The current literature will be announced by the lecturer at the beginning of the module.

Transcript of records:
- Lasers: Basic principles and applications
- Laser principle, Properties, Types of lasers, Applications in industry and research

MEASURE METHODICS

Westphalian University of Applied Sciences, Campus: Gelsenkirchen

ECTS	Workload	Study Semester	Duration	Frequency
6	180 h	5th semester / Bachelor	One semester	Summer semester

Courses	Attendence Time	Self-Study	Group Size
Lecture 3 h Practical training 1 h (per semester week)	45 h 15 h	90 h 30 h	Lecture: limited as per notice Practical training: 15

Learning outcomes/Objectives

Students can apply basic characterization methods in semiconductor processes (FTIR, TLM, µ-PCD, LBIC, EBIC, EL, IR, etc.) and have internalized the underlying principles. They are able to apply these methods directly to the various semiconductor processes in order to draw conclusions about the quality of the individual processes. Through the in-depth handling of the individual measuring devices, students will be able to make discrete suggestions for the use of the measuring methods in the event of process problems. Using selected examples, they will be able to use these methods independently and provide tips for applications in process and quality control. In discussions, the lecture content is transferred to practical applications, thereby promoting the ability to independently develop new fields of activity.

Contents

The participants characterize semiconductors, in particular solar cells and modules, during and after the various manufacturing process steps. They will differentiate between the measurement methods with regard to the physical principles: methods based on optical and electrical principles. Students will learn about modern measurement methods, such as determining contact and sheet resistance, charge carrier lifetime, doping concentration in the crystal, diagnostic methods such as infrared, photo- and electroluminescence, which will be finally introduced to applications in process and quality control. In small groups, they assess the typical diagnostic procedures for solar modules, different IV characteristics and the effect of series and shunt resistances on the generated power and possible reduced lifetimes in practical experiments.

Teaching Methods

Lecture, practical training

Participation Requirements (Prerequisites/ Eligibility)	Requirements for award of ECTS points
Eligibility to participate in this course is subject to individual assessment. Please directly contact the lecturer for more information.	Passing the examination and the practical training
Forms of examination (Type)	**Requirements for taking the exam**
Written examination	None

Use of the module

Optional

Importance of the grade of the module to the final score

According to the examination regulations

Module Coordinator	Lecturer
Prof. Dr. Andreas Schneider	Prof. Dr. Andreas Schneider

Additional Information:

The current literature will be announced by the lecturer at the beginning of the module.

OBJECT-ORIENTED PROGRAMMING IN C++

Westphalian University of Applied Sciences, Campus: Gelsenkirchen

ECTS	Workload	Study Semester	Duration	Frequency
6	180 h		One semester	
Courses		**Attendence Time**	**Self-Study**	**Group Size**
2 h lecture | 1 h practical work | 1 h exercise session (per semester week)		56 h	124 h	

Learning outcomes/Objectives

- Understanding of the concepts of object-oriented programming in C++
- Confident handling of the syntax of C++, especially pointers and references
- Understanding operator overloading, especially in connection with containers
- Practiced handling of templates and corresponding libraries

Contents

- Syntax extensions compared to C
- Conceptual differences compared to JAVA
- Default and copy constructors, initialization list
- Operator overloading
- Inheritance and multiple inheritance
- Templates, containers and iterators
- Working with the standard template library
- Advanced template applications
- Exception handling in C++

Teaching Methods

Lecture, Practical work and exercise sessions

Lecturer

Dr. Pedro Novo

Additional Information:

The current literature, the forms of examination as well as the requirements for the award of credits will be announced by the lecturer at the beginning of the module.

PARALLEL PROGRAMMING

Westphalian University of Applied Sciences, Campus: Gelsenkirchen

ECTS	Workload	Study Semester	Duration	Frequency
6	180 h	4th semester / Bachelor	One semester	Summer semester

Courses	Attendence Time	Self-Study	Group Size
2 h lecture | 3 h practical work and exercise session (lab time) (per semester week)	70 h	110 h	

Learning outcomes/Objectives

Students learn the basics and concepts of parallel programming and the parallel programming paradigm and are able to develop and test parallel programs. They learn to parallelize sequential algorithms and to distribute them in parallel within the graphics card or multi-core architectures or across several computers. In addition to programming methodology, parallel patterns and design, students learn about the special problems and issues involved in parallel programming, in particular the recognition of concurrency and the more difficult error analysis.

Contents

- Basics of parallel programming
- Parallel architectures
- Design and analysis of parallel algorithms
- Threads
- OpenMP
- MPI
- OpenCL
- CUDA
- Parallel patterns (Map, Reduce, Scan, Sort, Neural Networks, ...)
- Operating system: Linux; teaching languages are C / C++, Python, ipython notebooks

Teaching Methods

Lecture, Practical work and exercise sessions (lab time)

Lecturer

Prof. Dr. Hartmut Surmann

Additional Information:

The current literature, the forms of examination as well as the requirements for the award of credits will be announced by the lecturer at the beginning of the module.

PRACTICAL SECURITY ATTACKS AND EXPLOITATION

Westphalian University of Applied Sciences, Campus: Gelsenkirchen

ECTS	Workload	Study Semester	Duration	Frequency
6	180 h	4th semester / Bachelor	One semester	Summer semester

Courses	Attendence Time	Self-Study	Group Size
1 h lecture | 3 h practical work (per semester week)	56 h	124 h	

Learning outcomes/Objectives

- Understand common procedures for system security, system integrity and software protection
- Apply mechanisms to identify and exploit software vulnerabilities
- Apply attack techniques in computer networks
- Acquire knowledge in the field of malware detection and defense
- Participate in a capture-the-flag competition

Contents

Students learn the applicability and limitations of security-related attacks against systems, network protocols and software.

The following topics are covered:
- Linux and Unix-like operating system basics
- Vulnerability research
- Reconnaissance and scanning
- System security and operational security
- Software security
- Bytecode and binary code analysis
- Denial-of-service attacks
- Web security
- Incident response

Each course unit consists of an introduction in the form of at least one lecture unit and task that have to be solved in the practical course. In addition, students must design their own vulnerable examples as tasks that could be used, for example, as part of their own CTF competition.

Teaching Methods

Lecture, Practical work

Lecturer

Prof. Dr. Christian Dietrich

Additional Information:

The current literature, the forms of examination as well as the requirements for the award of credits will be announced by the lecturer at the beginning of the module.

SPECIAL ELECTRICAL MACHINES AND DRIVES

Fachhochschule Dortmund – University of Applied Sciences and Arts

ECTS	Workload	Study Semester	Duration	Frequency
3	90 h	6th semester / Bachelor	One semester	Summer semester
Courses		**Attendence Time**	**Self-Study**	**Group Size**
Lecture | Exercise		36 h	54 h	

Learning outcomes/Objectives

In the course „Special electrical machines and drives“, students are enabled to apply the knowledge they have acquired in the fundamentals of electrical machines to a wide range of special machines. Students learn about various requirements where standard machines can no longer be used. They can, on the one hand, justify why special machines are then required and, on the other hand, also why the special machines used meet the requirements exactly. For each machine, its construction, areas of application and operating behavior are explained and evaluated.

Contents

Synchronous reluctance motor, Linear motor, Hermetic pumps (canned motor, magnetic coupling), Submersible moto, High-speed motor, Stepper motor, High-torque motor, Explosion-proof motor, Axial flux motor, High-efficiency motor

Teaching Methods

Seminar-based course conducted in English. Presentations.

Participation Requirements (Prerequisites/ Eligibility)	**Requirements for award of ECTS points**
Formal: The requirements of the currently valid examination regulations apply Content:	
Forms of examination (Type)	**Requirements for taking the exam**
Written or oral exam, or presentation	Module exam must be passed

Use of the module

BA Electrical engineering

Importance of the grade of the module to the final score

According to the examination regulations

Module Coordinator	**Lecturer**
Prof. Dr. Nick Raabe	Prof. Dr. Nick Raabe

Resources

Technical articles, Manufacturer information

STATISTICS FOR ENGINEERING SCIENCES

Bochum University of Applied Sciences

ECTS	Workload	Study Semester	Duration	Frequency
5	150 h		One semester	Summer semester

Courses	Attendence Time	Self-Study	Group Size
2 h lecture | 1 h exercise | 1 h practical training (4 h per semester week)	64 h	86 h	

Learning outcomes/Objectives

The students learn how to apply standard descriptive methods to univariate and to multivariate data. They are familiar with the basic concepts of probability theory and common para- metric distribution models. They know when and how to apply common hypothesis tests.

Contents

- Types of data measurement scales
- Describing empirical data sets
- Graphical representation
- Kolmogorov's laws of probability
- Conditional probability and independent events
- Bayes theorem and law of total probability
- Random variables, expectation, and variance
- Discrete parametric distribution models
- Continuous parametric distribution models and density functions
- Point estimation and interval estimation
- Concepts of hypothesis testing Binomial tests
- Tests using normal distribution assumption

Teaching Methods

Lecture, Exercise, Practical training (with R / R Studio)

Participation Requirements (Prerequisites/ Eligibility)	Requirements for award of ECTS points
Mathematik I and II	Passing the exam and successful participation in the practical training
Forms of examination (Type)	**Requirements for taking the exam**
Written exam	
Module Coordinator	**Lecturer**
Dipl.-Math. André Thrun	Dipl.-Math. André Thrun

STUDY PROJECT

Bochum University of Applied Sciences

ECTS	Workload	Study Semester	Duration	Frequency
5	150h	6th semester / Bachelor	One semester	Every semester
Courses		**Attendence Time**	**Self-Study**	**Group Size**
SP: Study Project 4S		64 h	86 h	Up to 4 students

Learning outcomes/Objectives

The students are able to work on a practical development project, also in a team. They are in the position to use their theoretical knowledge.
The students know the fundamentals of project management (project philosophy, project targets, criteria for success and failure, process and time management, resource planning etc.) and of team development (team anatomy, team roles, group dynamics, hierarchy, team development methods, team interaction, conflict management etc.). They are able to use this knowledge in a practical assignment.

Contents

Project topics will be assigned according to the specialization of the different laboratories of the department.
Practical application of theoretical and methodological knowledge

Teaching Methods

Project work alone or in a team

Participation Requirements (Prerequisites/ Eligibility)	**Requirements for award of ECTS points**
None (for international students)	Assessment rated at least „adequate“
Forms of examination (Type)	**Requirements for taking the exam**
Presentation (30 min. with handout) or paper (20 pages)	None

Importance of the grade of the module to the final score

5/225

Module Coordinator	**Lecturer**
Prof. Dr. Götz Lipphardt / all full-time lecturers of the department	Prof. Dr. Götz Lipphardt / all full-time lecturers of the department

TECHNICAL ENGLISH – MECHATRONICS/MECHANICAL ENGINEERING

Westphalian University of Applied Sciences, Campus: Bocholt

ECTS	Workload	Study Semester	Duration	Frequency
6	180 h		One semester	Summer semester

Courses	Attendence Time	Self-Study	Group Size
Technical English – Mechatronics/Mechanical Engineering	60 h	120 h	20 - 30 students

Learning outcomes/Objectives

Upon completion students will be able to engage successfully in occupation-oriented and academic discourse settings using appropriate English while taking into account (inter)cultural elements.

Contents

The course is an introduction to technical English language based on selected topics from various relevant fields, e.g.:

- basic geometry and algebra,
- mechanics,
- robotics,
- automotive systems and
- renewable technologies.

Teaching Methods

Scheduled on-site teaching using a wide array of media. The classroom teaching is complemented by guided and independent study periods which are supported by a wide range of digital learning resources offered by the Language Centre (see below).

Participation Requirements (Prerequisites/ Eligibility)	Requirements for award of ECTS points
Formal: None In terms of content: advanced English skills as stipulated by the German University and Higher Education entrance regulations If needed: attendance of the “English Support Programme (ESP)” offered by the Language Centre	A minimum of 50% (50 points out of 100)
Forms of examination (Type)	**Requirements for taking the exam**
Written exam (120 min)	None
Module Coordinator	**Lecturer**
The Language Centre	Mark Weller M.A., Dr. Thorsten Winkelräth et al. (The Language Centre)

Additional Information:

Resources → p. 19

Resources

TECHNICAL ENGLISH – MECHATRONICS/MECHANICAL ENGINEERING

Selected texts developed and provided by the Language Centre or based on reputable online publications

Internet-websites of Technology / Engineering / Science - related magazines, e.g.:

- www.eandt.theiet.org
- www.sciencedaily.com
- www.quantamagazine.org
- www.facilitiesshow.com
- www.scitechdaily.com
- www.techxplore.com/engineering-news/ (formerly: www.phys.org/technology-news/engineering)
- www.theengineer.co.uk
- www.nsf.gov/news/
- www.spectrum.ieee.org
- www.snexplores.org/ (formerly: www.sciencenewsforstudents.org/)
- www.techopedia.com
- www.sciencedirect.com

Web-based tutorials und educational materials, e.g.:

- www.howstuffworks.com
- www.energyeducation.ca/encyclopedia/Wind_turbine
- www.koyo.jtekt.co.jp/en/2019/06/column01-01.html (bearings)
- www.studentenergy.org/map/
- www.energy.gov
- www.energysage.com
- www.sciencing.com
- www.engineerstudent.co.uk/
- www.interestingengineering.com/
- www.techaddu.wordpress.com/
- www.themechanic.weebly.com/
- www.instructables.com/
- www.electricalacademia.com
- www.alternative-energy-tutorials.com/
- www.thegraduateengineer.com
- www.electricalclassroom.com
- www.smartgrid.gov

Various YouTube Channels on topics like:

- maths (e.g. numberphile)
- computation
- vehicle propulsion technology (conventional, fuel cells, battery driven)
- renewable energy (e.g. hydro, solar, wind and wave power)
- robotics
- electrical grid

IT/Multimedia-related (audio-video) podcast sources, e.g.:

- www.thenakedscientists.com
- www.npr.org

International Broadcasting Stations and their multimedia programmes: e.g.:

- www.bbc.co.uk – e.g. Tech Tent, Inside Science, The Science Hour, The Life Scientific
- www.npr.org/ - e.g. STEM spots

Print- or web-based sections of internationally renowned quality newspapers: e.g.:

- The Guardian
- The New York Times
- The Times
- The Washington Post

General English Dictionaries, e.g.:

- www.merriam-webster.com/
- en.oxforddictionaries.com
- www.collinsdictionary.com/dictionary/english
- dictionary.cambridge.org/dictionary/english/
- www.leo.org
- www.linguee.de/
- de.pons.com/
- www.dict.cc/
- de.langenscheidt.com/englisch-deutsch/
- www.onelook.com (search engine)

Resources

ENGLISH FOR SCIENCE AND TECHNOLOGY

Course Book:

David Bonamy (2011), TECHNICAL ENGLISH 4 (course book),
Pearson/Longman: Harlow. ISBN- 978-1-4082-2955-2

Internet-websites of Technology / Engineering / Science - related magazines e.g.:

- www.ingenia.org.uk
- https://eandt.theiet.org
- https://www.sciencedaily.com
- www.quantamagazine.org

https://www.facilitiesshow.com

- https://scitechdaily.com
- https://techxplore.com/engineering-news/ (formerly: https://www.phys.org/technology-news/engineering)
- https://www.theengineer.co.uk
- https://www.nsf.gov/news/
- https://spectrum.ieee.org
- https://www.snexplores.org/ (formerly: https://www.sciencenewsforstudents.org/)

Web-based tutorials and educational materials, e.g.

- www.howstuffworks.com (e.g. how Anti-Lock Brakes work)

Various YouTube Channels on topics like

- maths (e.g. numberphile)
- physics (e.g. the Large Hadron collider)
- electronics (e.g. LASER technology)
- mech. engineering (e.g. material properties)
- fac. engineering (e.g. smart buildings/the internet of things)

IT/Multimedia-related (audio-video) podcast sources, e.g.:

- www.thenakedscientists.com

International Broadcasting Stations and their multimedia programmes: e.g.

- www.bbc.co.uk – e.g. Tech Tent, Inside Science, The Science Hour
- www.npr.org/ - e.g. STEM spots

Print- or web-based sections of internationally renowned quality newspapers: e.g.

- The Guardian
- The New York Times
- The Times
- The Washington Post

General English Dictionaries, e.g.

- www.merriam-webster.com/
- en.oxforddictionaries.com
- www.collinsdictionary.com/dictionary/english
- dictionary.cambridge.org/dictionary/english/
- www.leo.org
- www.linguee.de/
- de.pons.com/
- www.dict.cc/
- de.langenscheidt.com/englisch-deutsch/
- www.onelook.com (search engine)

Technology / Engineering / Science - specific dictionaries, e.g.

- https://www.engineering-dictionary.com
- https://www.lexicool.com/online-dictionary.asp?FSP=C153&FKW=engineering
- http://www.dictionary.bi.htwg-konstanz.de/index.php?load=start&lang=en
- https://www.thesciencedictionary.com/
- http://www.worldofscience.in/dictonary.aspx

English Learning Software / Blended-Learning Modules:

- ET - Exam Trainer (in-house development by the Language Centre)
- FFT - Fast Formula Trainer (in-house development by the Language Centre)
- ESP - English Support Programme (in-house development by the Language Centre)
- various E-learning products, tools and further in-house developments

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