

## Industrial Communication (E745006)

**Course size** *(nominal values; actual values may depend on programme)*

**Credits 3.0** **Study time 85 h**

**Course offerings and teaching methods in academic year 2023-2024**

A (semester 1) Dutch Gent lecture

**Lecturers in academic year 2023-2024**

Verhaevert, Jo TW05 lecturer-in-charge

**Offered in the following programmes in 2023-2024**

	crdts	offering
<a href="#">Bachelor of Science in Engineering Technology(main subject Electromechanical Engineering Technology)</a>	3	A
<a href="#">Master of Science in Electromechanical Engineering Technology</a>	3	A

**Teaching languages**

Dutch

**Keywords**

Telecommunication, data communication

**Position of the course**

The course is situated in the learning track in electricity technology and installations and in the learning track drive technology and automation. It has the following objectives:

- Learn the basics and concepts in order to gain insight in modern communication systems, as they are applied in industrial environments
- Understand and be able to analyse different real life case studies: field buses, Personal Area Networks, Wireless Sensor Networks and computer modems

**Contents**

- Setting and history of communication, description of communication systems, types of communication (types of information, geographical spreading, direction of communication, connection types, topology), OSI reference model
- Analogue and digital signals, bandwidth, sampling (Nyquist theorem) and quantising, PAM, PCM, DPCM, DM, ADPCM...
- Channel properties: transfer function, noise (types of noise, noise figure, noise temperature), signal to noise ratio, channel capacity of Shannon, amplitude distortion and phase distortion
- Electromagnetic propagation, guided waves on telephone lines (distributed parameters, attenuation), on coaxial cable (attenuation) and on optical fibre (internal reflection, fibre types, attenuation)
- Electromagnetic propagation with non-guided waves: radio propagation mechanisms, connection between two antennas, power budget analysis (free space, transmission over the earth)
- Digital communication using base band channel: choice of wave form, choice of pulse form (Unipolar-Bipolar, NRZ-RZ, AMI, Manchester...), more than 2 different wave forms and digital communication using band pass channel (ASK, FSK, PSK, QAM), constellation diagram
- Error coding (parity, two-of-five-code, repetition code, CRC, Hamming, convolution...) and encryption (stream and block encryption, symmetric and asymmetric keys)
- Case study fieldbuses: Profibus, CAN-bus, other standards (KNX, Industrial Ethernet, Foundation Fieldbus)
- Case study Personal Area Networks: RS-232, USB, wUSB, FireWire, Bluetooth, IrDA, RFID, NFC
- Case study Wireless Sensor Networks: IEEE802.15.4, ZigBee, WirelessHart, Z-Wave, WISA
- Case study computer modems: voice band modem, xDSL

**Initial competences**

Builds upon certain final competences of the courses 'Signalen en Systemen II'

**Final competences**

- 1 Acquire insight in the basics of communication (with e.g. analogue and digital signals)
- 2 Analyse and interpret channel properties
- 3 Apply practically electromagnetic wave propagation: twisted pair, coax, fibre and wireless communication
- 4 Analyse different types of digital communication: ASK, FSK, PSK and QAM
- 5 Execute properly error coding and encryption
- 6 Understand and explain the design choices of modern industrial communication networks (fieldbuses, PAN, WSN and computer modems)

**Conditions for credit contract**

Access to this course unit via a credit contract is determined after successful competences assessment

**Conditions for exam contract**

This course unit cannot be taken via an exam contract

**Teaching methods**

Lecture

**Learning materials and price**

- Syllabus (7 euro)
- Hand-outs of the slides and additional documentation on the electronic learning environment

**References****Course content-related study coaching**

The lecturer is available for further information via various channels (during and after the course, via e-mail or by appointment).

**Assessment moments**

end-of-term assessment

**Examination methods in case of periodic assessment during the first examination period**

Written assessment open-book

**Examination methods in case of periodic assessment during the second examination period**

Written assessment open-book

**Examination methods in case of permanent assessment****Possibilities of retake in case of permanent assessment**

not applicable

**Calculation of the examination mark**

Written assessment open-book: 100%