Course Specifications
Valid as from the academic year 2018-2019

Industrial Communication (E745006)

Course

Lecturers in academic year 2019-2020

Verhaevert, Jo
TW05
lecturer-in-charge

Course offerings and teaching methods in academic year 2019-2020

A (semester 1) Dutch lecture 24.0 h

Offered in the following programmes in 2019-2020

<table>
<thead>
<tr>
<th>Programme</th>
<th>credits</th>
<th>offering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master of Science in Electrical Engineering Technology (main subject Automation)</td>
<td>3</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Electrical Engineering Technology (main subject Electrical Engineering)</td>
<td>3</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Electromechanical Engineering Technology</td>
<td>3</td>
<td>A</td>
</tr>
</tbody>
</table>

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

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

Credits 3.0  Study time 85 h  Contact hrs 24.0 h

(Approved)
• 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 'Fysica II' and 'Signalen en Systemen'

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).

Evaluation methods
end-of-term evaluation

Examination methods in case of periodic evaluation during the first examination period
Written examination, open book examination

Examination methods in case of periodic evaluation during the second examination period
Written examination, open book examination

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation
not applicable

Extra information on the examination methods
Written open book examination

Calculation of the examination mark
Written examination: 100%

(Approved)