GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2023-2024

Analogue Electronics II (E731039)

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

Credits 6.0 **Study time 180 h**

Course offerings and teaching methods in academic year 2023-2024

A (semester 1)	Dutch	Gent	lecture
			practical

Lecturers in academic year 2023-2024

Van Torre, Patrick	TW05	lecturer-in-charge

Offered in the following programmes in 2023-2024	crdts	offering
Bachelor of Science in Engineering Technology(main subject Electronics and ICT Engineering Technology)	6	A
Linking Course Master of Science in Electronics and ICT Engineering Technology(main subject Electronics Engineering)	6	A
Linking Course Master of Science in Electronics and ICT Engineering Technology(main subject Embedded Systems)	6	A
Linking Course Master of Science in Electronics and ICT Engineering Technology(main subject ICT)	6	A
Preparatory Course Master of Science in Electronics and ICT Engineering Technology(main subject Electronics Engineering)	6	A
Preparatory Course Master of Science in Electronics and ICT Engineering Technology(main subject Embedded Systems)	6	A
Preparatory Course Master of Science in Electronics and ICT Engineering Technology(main subject ICT)	6	A

Teaching languages

Dutch

Keywords

Integrated circuits, current mirrors, differential amplifiers, frequency behavior, feedback, stability, distortion, signal swing, oscillators, internal OpAmp circuitry, filters, tuned amplifiers.

Position of the course

The students should be able to employ different levels of abstraction in order to design analog electronic circuits, taking into account frequency behavior and stability, in different semiconductor technologies.

Contents

Differential and multistage amplifiers

- Differential pair with bipolar or MOS transistors
- Resistive load or current-mirror load.
- Differential half circuit for common-mode and differential-mode operation
- Common-mode and differential-mode amplification
- Common-mode rejection ratio

Frequency response

- Low-frequency response, closed-circuit time constants method
- High-frequency response, open-circuit time constants method
- Miller theorem
- Bandwidth of the different amplifier configurations

Feedback

- Series and shunt feedback
- Consequences of feedback for the amplification and the in- and output impedance and bandwidth.

- Stability of amplifiers and compensation

Output stages and power amplifiers

- Classification of power stages, class A, B en C
- Calculation of amplifier efficiency
- Class AB operation
- IC power amplifiers and amplifiers in bridge configuration

Operationel Amplifiers (internal circuits)

- Internal circuits of OpAmps
- 741 bipolar OpAmp
- Rail-to-rail input- and output stages

Filters and tuned amplifiers

- Butterworth en Chebyshev filters
- 2^{nd}-order RLC resonator
- Synchronous en stagger tuned amplifiers

Oscillators

- Sinusoidal oscillators
- RC, LC and crystal oscillators.
- Relaxation oscillators

MICROCAP simulation of circuits from the course.

- Applying the different methods of analysis and related parameter settings to AC amplifiers and oscillators.
- Extensive simulation of circuits treated in lab courses and theoretical exercises.

Initial competences

This course unit builds on certain course competencies/learning outcomes of course units Electronics, Electronics II and Analogue Electronics I.

Final competences

1 Design and analysis of the following circuits: AC amplifiers, including feedback and frequency behavior.
2 Design and analysis of the following circuits: OpAmps, output stages, tuned and power amplifiers, oscillators.
3 Simulation of AC amplifiers and oscillators.
4 Measurement of AC amplifiers and oscillators in the lab.

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, Practical

Extra information on the teaching methods

Theory:
(Online) lectures
Exercises:
Calculating circuits, design of circuits, simulations in SPICE.
Labs:
Construction of circuits. Measurement of amplifiers employing feedback as well as oscillators.

Learning materials and price

Book: "Microelectronic Circuits" by Adel Sedra and Kenneth Smith (The Oxford Series in Electrical and Computer Engineering) 7th edition.
Supporting material available via Ufora.

References

"Microelectronic Circuits", Adel Sedra & Kenneth Smith
"Introduction to electronic circuit design", Richard Spencer & Mohammed Ghausi.
"The Art of Electronics", Horowitz & Hill.
"Troubleshooting Analog Circuits", Robert Pease

Course content-related study coaching

Lectures + emailing and appointments for further questions possible.

Permanent supervision during lab session.

Assessment moments

end-of-term and continuous assessment

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

Written assessment with open-ended questions

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

Written assessment with open-ended questions

Examination methods in case of permanent assessment

Professional practice, Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible

Extra information on the examination methods

Theory: written open-book exam
Lab: permanent evaluation
Examination during the 2nd exam period is not possible for labs.

Calculation of the examination mark

- 3/4 theory
- 1/4 labs

When a student is absent without officially accepted reason (eg. doctor's notice) for 2 or more times in the lab, the student obtains an AFWE (absent) mark for the full course.
First and second exam period: in order to pass the course a minimum mark of 8/20 should be obtained for the theory part. In case this condition is not fulfilled, an average mark of 10/20 or more is reduced to 9/20.