LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Modern elektronik
Modern Electronics

ETIN70, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED E
Date of Decision: 2023-04-11

General Information

Compulsory for: N4-hn
Elective for: F4, F4-fel, MSOC1
Language of instruction: The course will be given in English

Aim

Modern electronics is both research on coming technologies and the foundation of industrial applications of established technology. The course provides basic knowledge in components and electronics and gives an overview of different established technologies. The course also provides a basis for new research concepts such as neuromorphic systems as well as advanced digital and analogue circuit design for IoT and 5G technology. Especially, the course aims to make available for students of varying background knowledge to study advanced courses in both materials driven electronics development and advanced circuit design, for example High Speed Devices, Nanoelectronics, and Analog IC Design.

The main theme in the course is the MOS transistor which is the dominant device used in commercial applications. The course provides a physics based description of the MOS transistor and describes its integration in basic amplifier stages. The frequency dependent propertiesof both the MOS transistor and the amplifiers will be treated.

Digital circuit applications based on the MOS transistor will be discussed in relation to logic gates and memory cells.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to explain the operation of the MOS and bipolar junction transistors
- be able to describe how the architecture of MOS and bipolar junction transistors affect their electrical characteristics
- know the frequency dependent properties of active and passive devices

Competences and skills
For a passing grade the student must

- be able to indentify the elements in a hybrid-pi model
- be able to use a small signal model for circuit design
- be able to design an amplifier based on negative feedback
- be able to analyse transistors and circuits in the frequency domain

Judgement and approach
For a passing grade the student must

- understand why different transistor technologies are used for various applications

Contents

Introduction to semiconductors, charge carriers, transport and the pn-junction. The large and small signal models for bipolar junction and MOS transistors. Short channel effects in modern devices. Single stage amplifiers, feed-back amplifiers, cascode amplifiers, power amplifiers and OP-amplifiers. Frequency response and bandwidth. The cource includes one compulsory laboratory exercise and one circuit simulation project.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Written examination. Hand-in assignments. Laboratory work, with preparation exercises.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts
Code: 0121. **Name:** Written Examination.
Credits: 5. **Grading scale:** TH. **Assessment:** Passed Examination **Contents:** Written Examination
Code: 0221. **Name:** Laboratory Work.
Credits: 1. **Grading scale:** UG. **Assessment:** Approved Laboratory Work **Contents:** Laboratory Work
Code: 0321. **Name:** Hand-in Assignments.
Credits: 1,5. **Grading scale:** UG. **Assessment:** Approved Hand-in Assignments **Contents:** Hand-in Assignments

Admission

Assumed prior knowledge: FFFF01 Electronic Materials or FFFF05 Solid state physics
The number of participants is limited to: No
The course overlaps following course/s: ETI290

Reading list

- A. S. Sedra, K. C. Smith, T. C. Carusone, V. Gaudet: Microelectronic Circuits (8th international edition). Oxford University Press, 2020, ISBN: 978-0-19-085350-1.

Contact and other information

Course coordinator: Lars Ohlsson Fhager, lars.ohlsson_fhager@eit.lth.se
Course homepage: https://www.eit.lth.se/course/etin70
Further information: With less than 16 participants, the course may be given with reduced teaching and more self studies.