Modern Electronics – ETIN70 – 7.5 credits

- **Practical details**

http://www.eit.lth.se/course/etin70

Teachers

- Johannes Svensson (first 4 lectures)
  (room: E2322, johannes@eit.lth.se)

- Lars Ohlsson Fhager (last 10 lectures)
  (room: E2321 , lars.ohlsson@eit.lth.se)

- Heera Menon (measurement lab session / exercises)
  (room: E2316 , heera.menon@eit.lth.se)

- Stefan Andric (circuit simulation intro and project)
  (room: E2316 , stefan.andric@eit.lth.se)

- Abinaya Krishnaraja (exercises)
  (room: E2313 , abinaya Krishnaraja@eit.lth.se)

- Course administrator: Erik Göthe
  (room: E:3152b, erik.gothe@eit.lth.se)

Johannes Svensson

Lars Ohlsson

Heera Menon

Stefan Andric

Abinaya Krishnaraja

Sign-up / Registration

- Students from
  - Embedded electronics engineering (master program)
  - Engineering nanoscience
  - Physics
  - Engineering physics
  - PhD programs
  - Other international

- Not on ”signed up” list? Have you confirmed that the course can be used in your exam? If, so sign the list!

- **YOU** have to register **yourself** in LADOK. This is not possible until ”signed up”. If not on list registration will be done by programme planners i.e. may take some time.

- Please give notice by email if you quit the course!

Aim – course plan

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. **Bipolar junction transistors** will be discussed.
The **frequency dependent properties** of both the MOS transistor and the **amplifiers** will be treated. **Digital circuit applications** based on the MOS transistor will also be discussed.

Learning outcomes

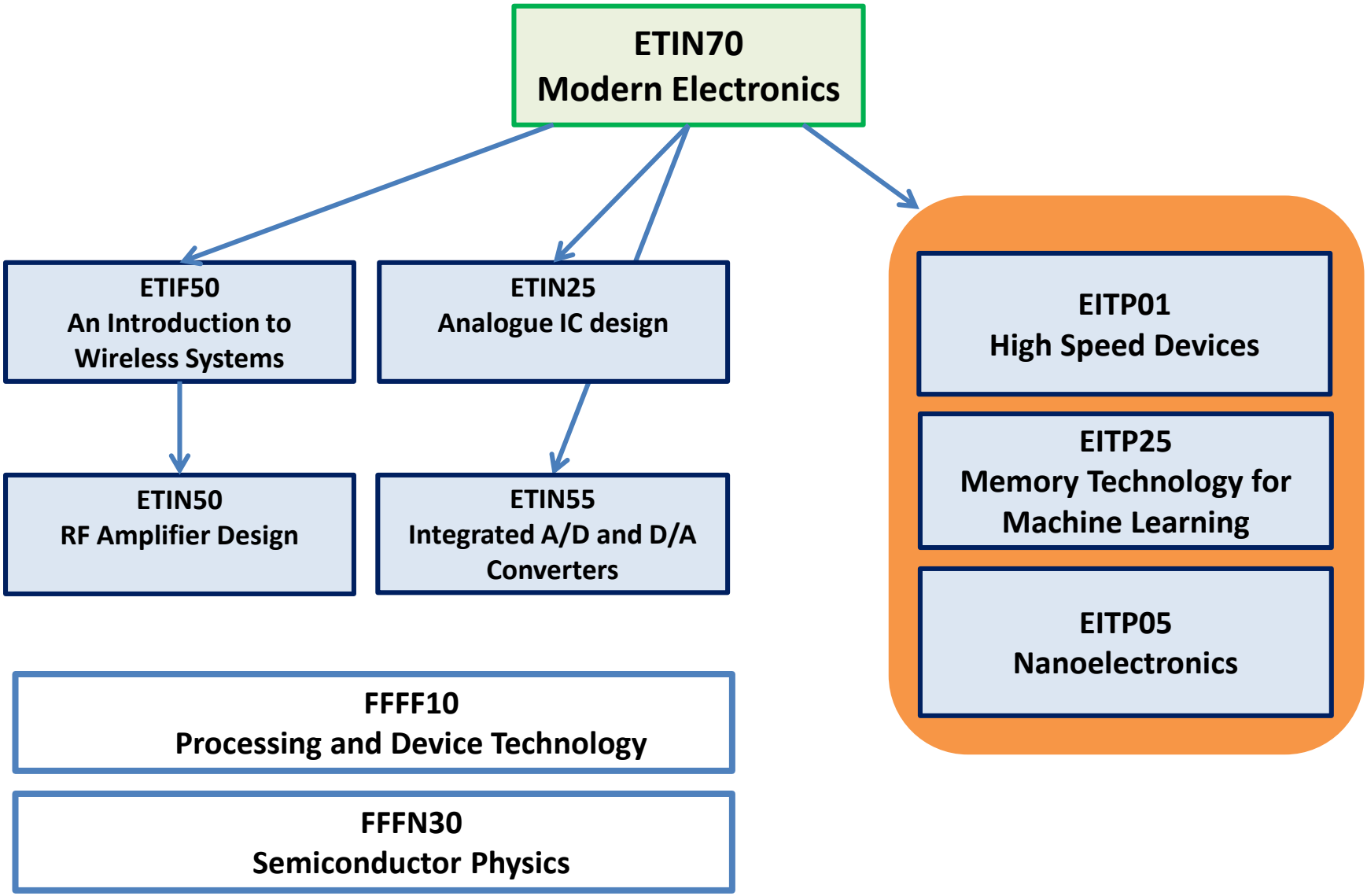
For a passing grade the student must:

- 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
- be able to identify 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
- understand why different transistor technologies are used for various applications

Scope of this course

- How does a bipolar transistor work?
- How does a field effect transistor work?
- How do we analyse small-scale circuits?
- What are the frequency dependent properties?
- How to design basic amplifiers and memory cells?
- When do we use feed-back?
- How are transistors used in integrated circuits?

Related Courses



Schedule

- 15 (x 2h) lectures tues 8.15-10.00 E:2311
  thur 8.15-10.00 E:2311

- 7 (x 2h) excercises fri 10.15-12.00 E:3139

- 2 (x4 h) measurement lab sessions wed 18/9 13.15-17.00
  thur 19/9 13.15-17.00 E:2424 / 2425

- 2 (x4 h) simulation lab sessions wed 25/9 8.15-12.00
  thur 26/9 13.15-17.00 E: 2435 (rödnäbba/blåtunga)

- written exam
  thur 31/10 8.00-13.00 E:2311
  (formulas (given on exam)
  and calculator allowed))

http://www.eit.lth.se/course/etin70

Course homepage

www.eit.lth.se/course/etin70

- Schedule with lecture notes - on web at least day before lecture
- Exercises
- Solutions to exercises – on web a few days after the exercise session
- Lab instructions
- Collection of useful formula (to be updated…) – Allowed on the exam
- Link to ”Hyperphysics” and other book for introduction to semiconductors

Course book

Microelectronic Circuits
7th International Edition

Adel Sedra, Kenneth Smith