



ELECTRONIC DEVICES

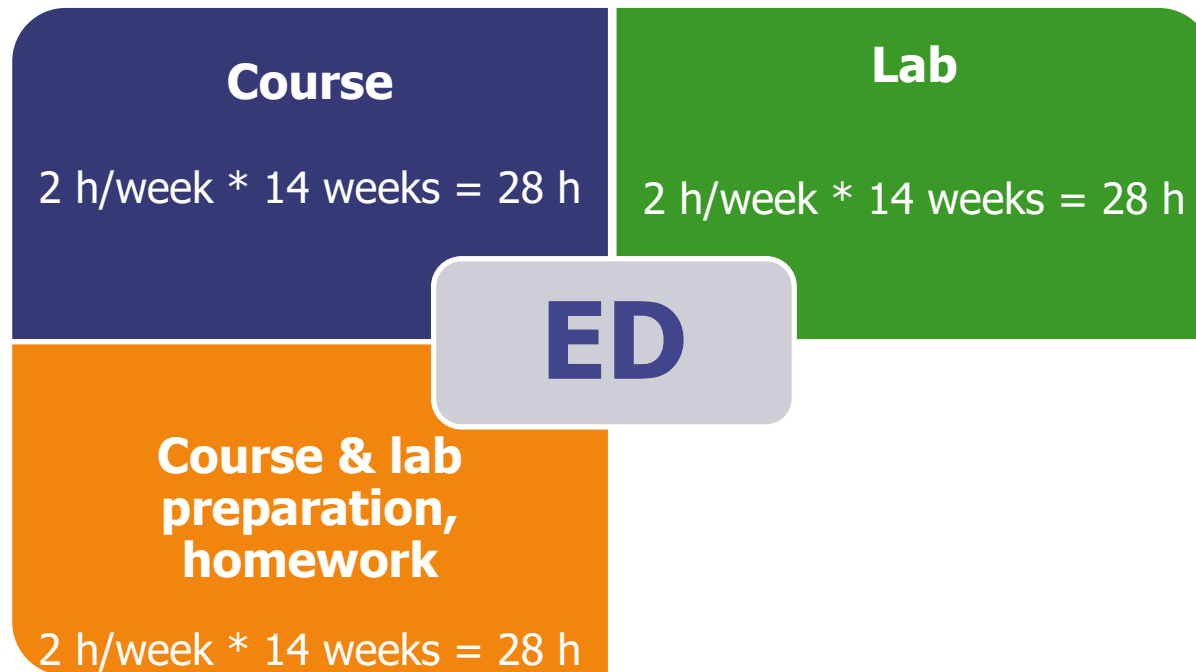
Assist. prof. Laura-Nicoleta IVANCIU, Ph.D.

C14 – Recap. Preparation for exam

Contents

- Amount of work
- Evaluation
- Course overview
- Online exam details
- Tips and tricks

Amount of work - completed



Amount of work – to be done



Evaluation

Written exam (E)
0...10 points

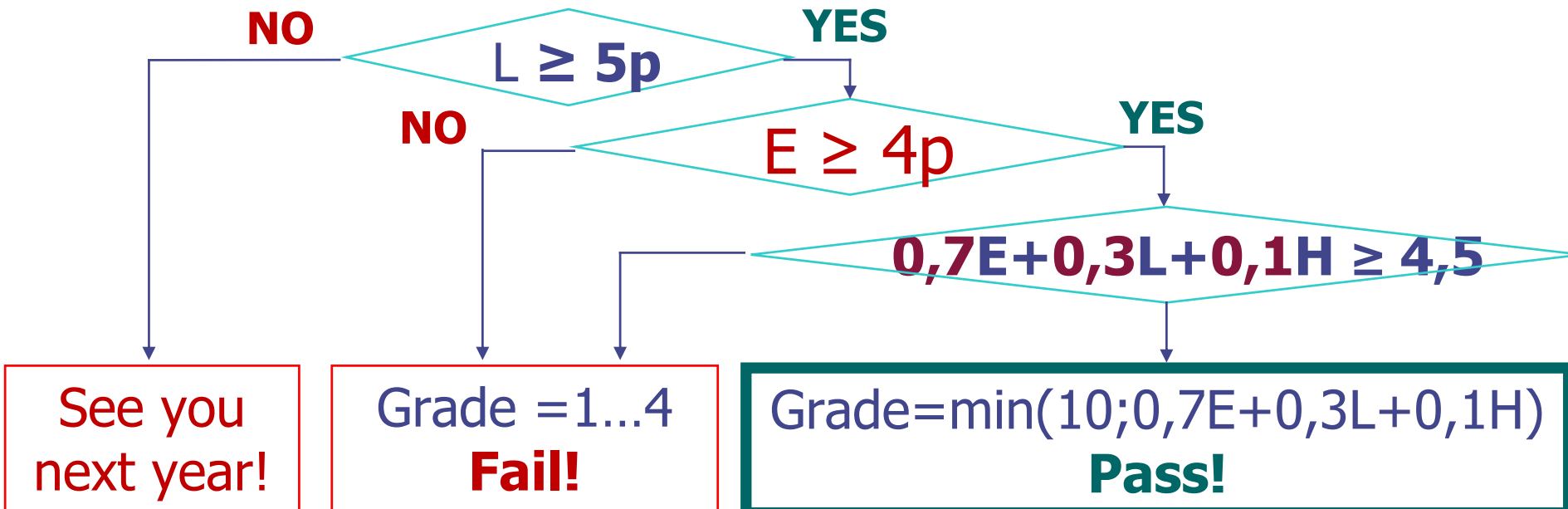
- problem solving

Laboratory (L)
0...10 points

- full attendance
- activity
- practical test

Course homeworks (H)
0...10 points

- 10 homeworks - optional



Course overview

Fundamentals

- Electrical signals
- Relations and laws for electrical circuits
- RC circuits – time and frequency response

C1

Diodes (D)

- Types, operating principle, characteristic, parameters
- Diode circuits
- Zener diodes, LEDs

C2 – C5

Operational Amplifiers (OpAmps)

- Ideal OpAmp, operating principle, characteristics, parameters, operating modes
- OpAmp comparators
- OpAmp amplifiers
- Applications with OpAmp

C6 – C10

Transistors (T)

- Types, operating principles, characteristics, parameters
- Bipolar junction transistors (BJTs)
- Field-effect transistors (MOSFET)

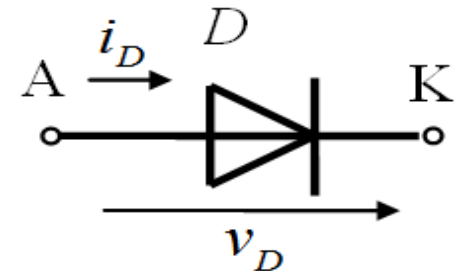
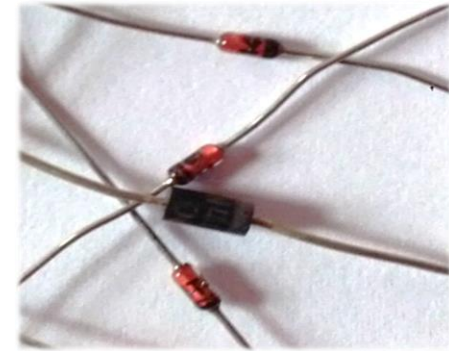
C11 – C13

C1 - Fundamentals

- Electrical signals, sources
- Ohm's law
- Kirchhoff's law
- Resistive divider
- Superposition method
- Millman's theorem
- RC circuits – time and frequency domain behaviors, filters

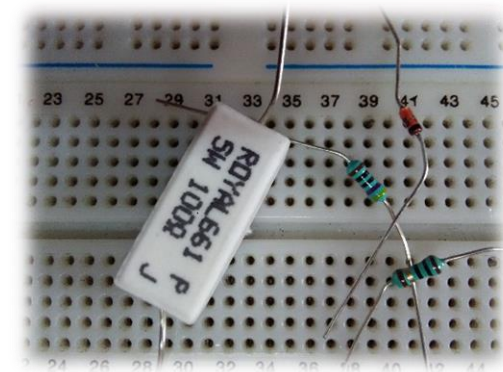
C2 – Diodes. DR circuits

- Physical structure. Symbol.
- Current-voltage characteristic
- Operating regions
- Operating (quiescent) point
- Parameters of the diode
- Constant voltage drop model
- Analysis of two-port DR networks



C3 – DR switching circuits

- Two-port DR networks. DR switching circuits.
- Voltage transfer characteristic (VTC)
- Two-port DR networks analysis
- Applications of two-port DR networks
 - Half-wave rectifier
 - Pulses selector
 - Voltage limiter
 - Maximum multi-port networks
 - Minimum multi-port networks



C5 – Zener diodes. Operational amplifiers. Simple comparators with OpAmp.

➤ Zener diodes

➤ The Operational Amplifier (OpAmp)

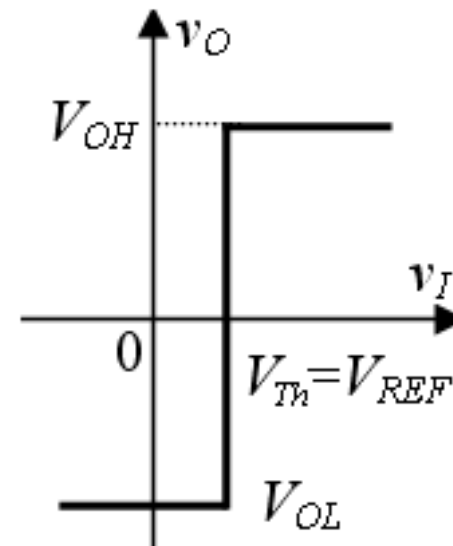
- OpAmp terminals
- OpAmp operation
- OpAmp model
- Ideal OpAmp
- Relation between output and input voltages



C6 – Simple comparators with OpAmp.

➤ Simple comparators with OpAmp

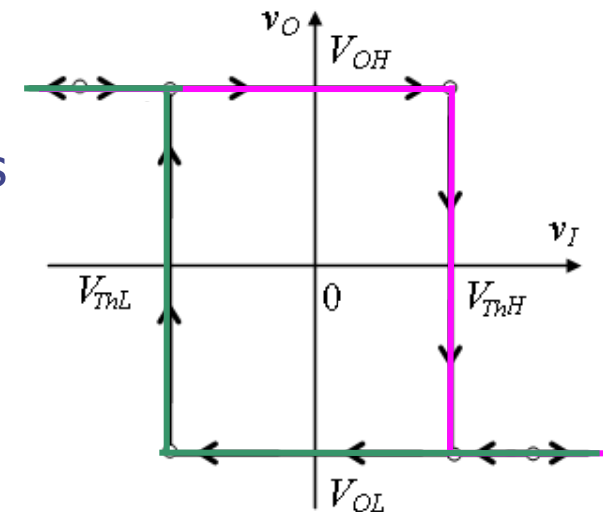
- Simple comparators with $V_{Th} = 0\text{ V}$
- Simple comparators with $V_{Th} \neq 0\text{ V}$
- Applications



C7 – Hysteresis comparators with OpAmp

➤ Hysteresis (PF) comparators with OpAmp

- Motivation
- Difference between simple and hysteresis comparators
- Inverting hysteresis comparators
 - w/ symmetric threshold voltages
 - w/ asymmetric threshold voltages
- Non-inverting hysteresis comparators
- Applications



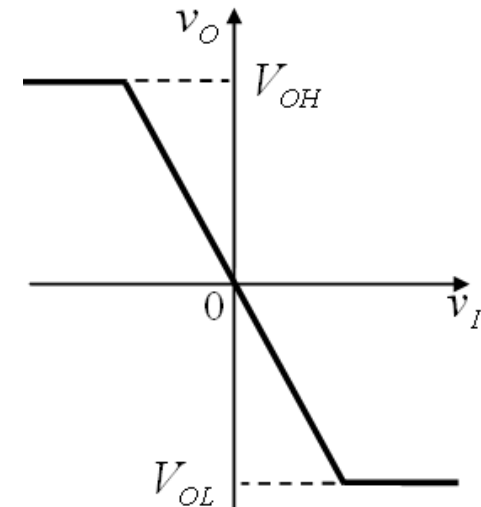
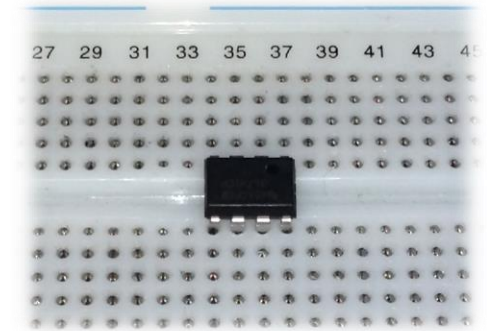
C8 – Electronic amplifiers. Amplifiers with OpAmp.

➤ Electronic amplifiers

- Types of supply
- Power transfer and power balance
- Types of amplifiers
- VTC
- Modeling the voltage amplifier
- Amplifier performances
- Frequency response

➤ Amplifiers with OpAmp

- Non-inverting amplifier
- Inverting amplifier



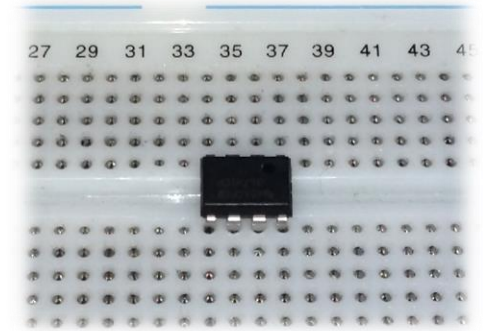
C9 – Summing and differential amplifiers with OpAmp.

➤ Summing amplifiers

- Inverting summing amplifier
- Non-inverting summing amplifier

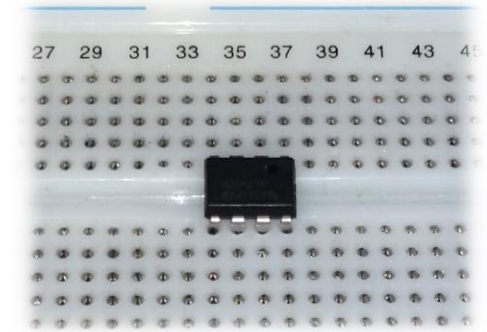
➤ Differential amplifiers

$$v_O = f(v_{I1}, v_{I2})$$

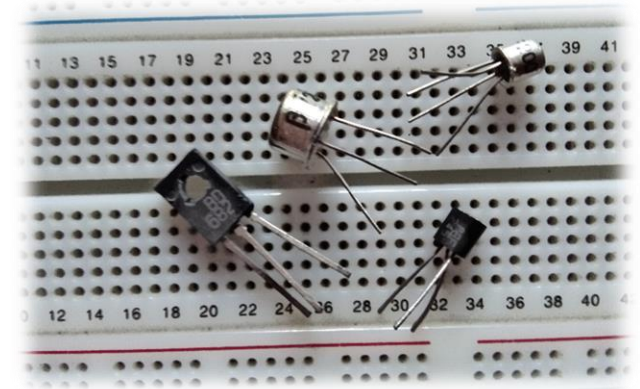


C10 – Applications with OpAmp.

- Voltage domain conversion circuits
- Capacitively coupled amplifiers
- Op-amp amplifiers operated from a single power supply
- Integrators and differentiators – active filters
- Half-wave and full-wave precision rectifiers
- Precision peak detectors
- Current sources
- Logarithmic and exponential amplifiers
- Circuits for multiplication and division

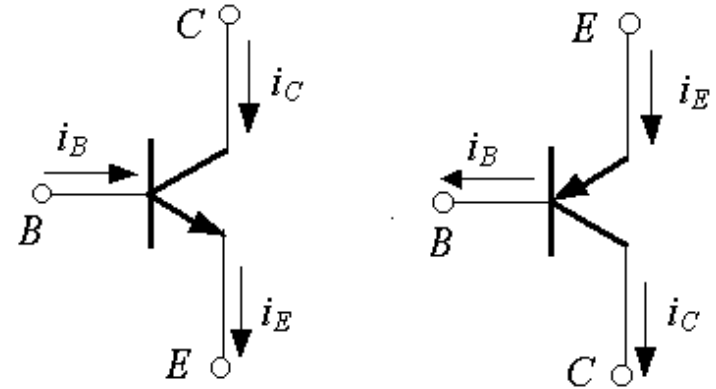


C11 – Transistors. BJTs.



- Types of transistors
- Operating principle. Operating regions.
- n-type transistors. Transfer characteristics.
- p-type transistors. Transfer characteristics.
- Bipolar junction transistors (BJTs)

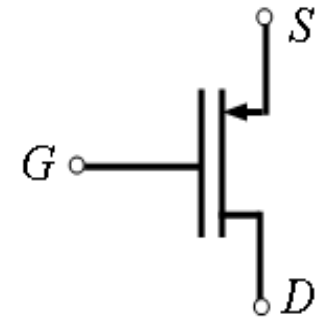
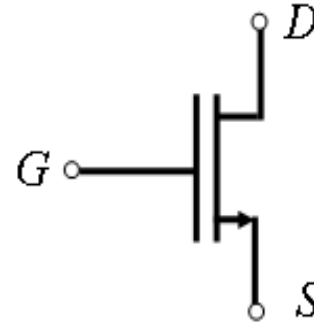
C12 – BJT operation.



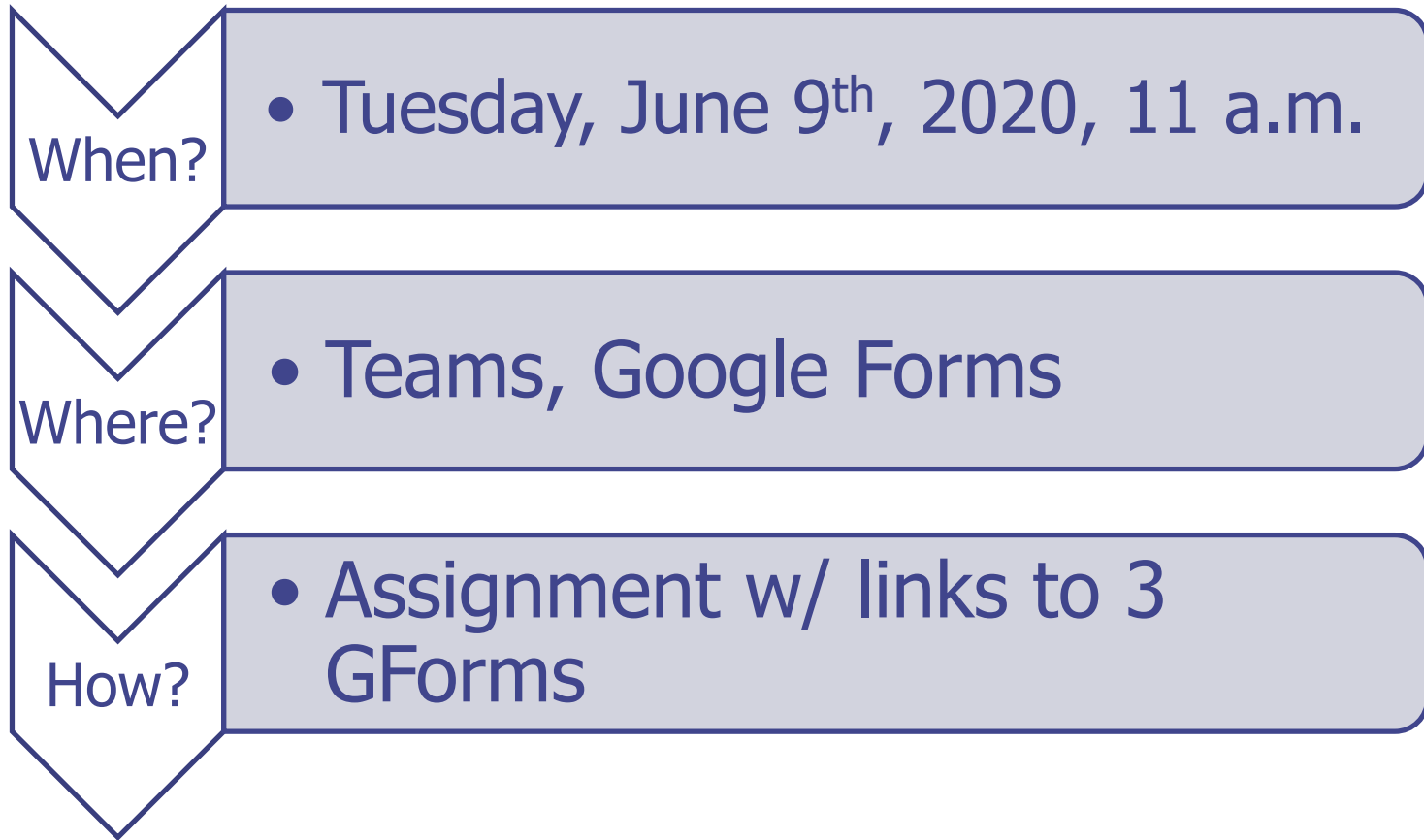
- Simplified structure of a BJT
- Input and transfer characteristics, npn BJT
- Operating regions
- Currents. Limiting the command current.
- BJT saturation
- Quiescent point of the BJT
- Examples

C13 – MOSFET operation.

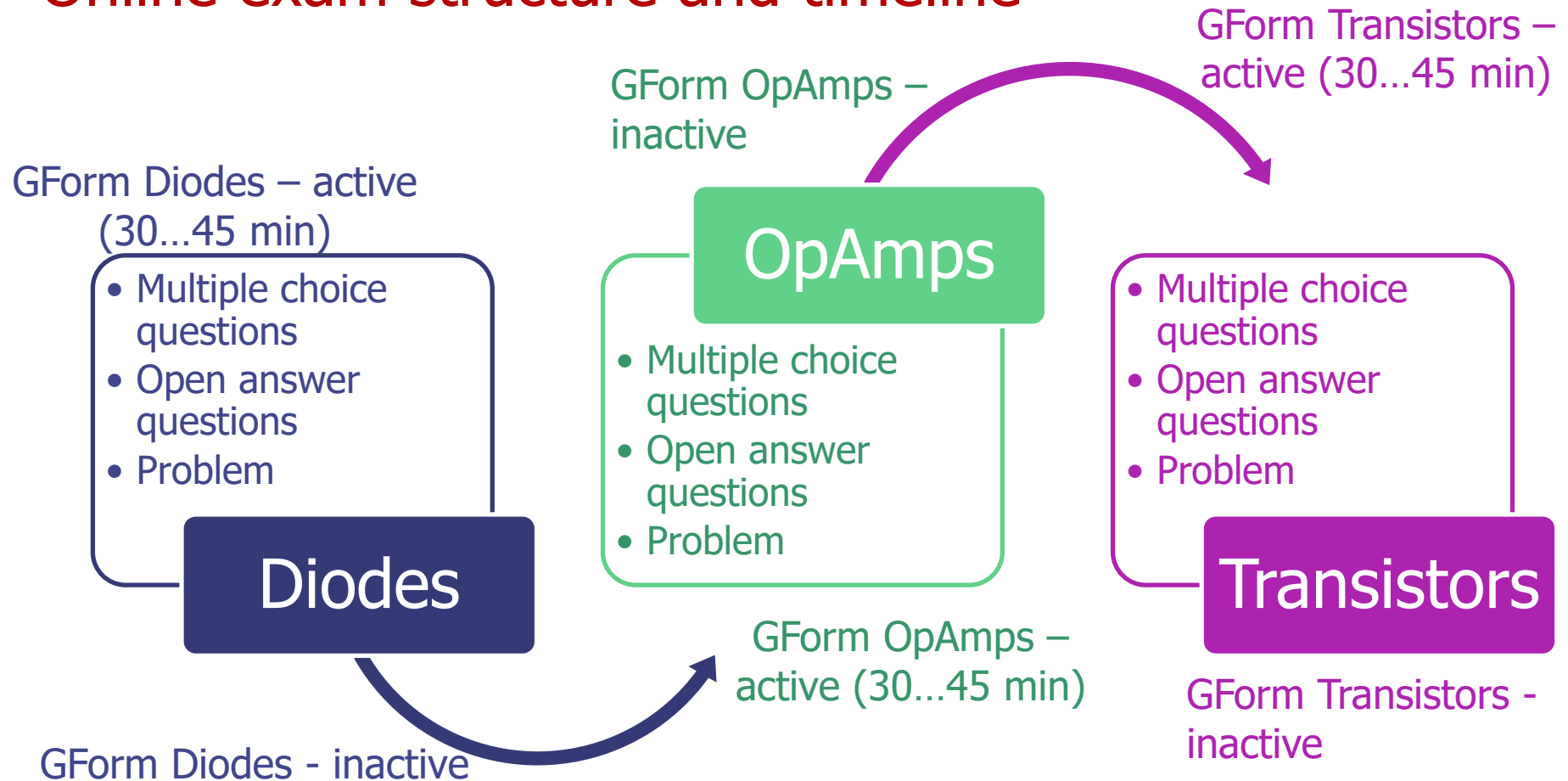
- Symbols
- Structure and physical operation
- Operating principle
- Transfer and output characteristics
- Quiescent point
- Operating regions
- Examples



Online exam details



Online exam structure and timeline



At the end: 10 min to scan & upload the solutions for the problems in the Assignment

- Each sheet of paper you upload must have the student's name, surname and group written in the top right corner
- Make sure the scans/photos are clear & visible
- At any given time during the exam, you may be requested to turn on your microphone and camera

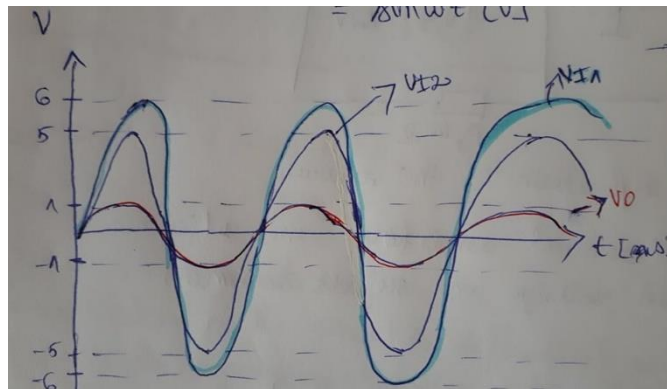
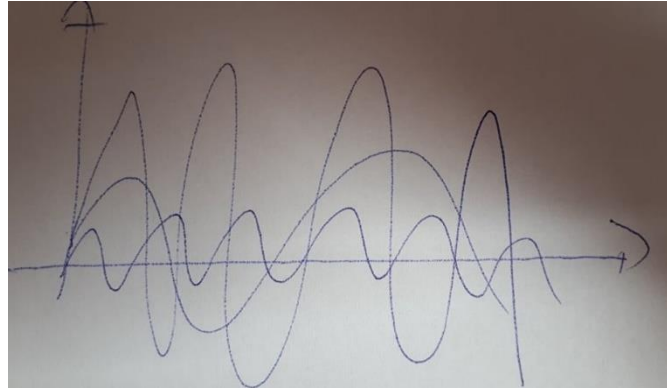
Tips and tricks

- Online exam = open-book exam
- The focus is on evaluating the students' ability to apply, synthesize, interpret the information
- All resources available during the exam

Tips and tricks

- No need to memorize equations, circuits, etc
- Time limits: enough time to search for an exact equation, not enough time to figure out how it is used/what it does

Tips and tricks



Tips and tricks

- “Binge” on the course videos
- Check out the extra documents, course homework and the collection of solved problems
- Solve the **examples** from the slides/course **homeworks** (Ro/En)
 - <http://www.bel.utcluj.ro/dce/didactic/ed/>
 - <http://www.bel.utcluj.ro/dce/didactic/de/>
- Pay attention to **all** the **requirements**
- Careful with the **numerical values** and **measuring units**
- Careful with the **signs (+/-)**
- Make sure your solution is **coherent**
- Make sure your drawings are **explicit**

