# Detailed Program and Requirements

| | | | | |
|---|---|---|---|---|
| **Óbuda University**<br>Bánki Donát Faculty of Mechanical and Safety Engineering | | | Institute of Mechatronics and Vehicle Engineering | |
| Course title and code: **Electronics BMXEL93BNE** | | | | Credits: 5 |
| Faculties in which the subject is taught: mechatronics engineer BSc | | | | |
| Supervised by: | Dr. Nagy András | Instructors: | Dr. Nagy András | |
| Prerequisites conditions: | Electrotechnics, BMXET12BNF | | | |
| Lessons per week: | Theory: 2 | Practice (in Auditorium): 1 | Laboratory: 1 | Consultation: |
| Exam type (s,v,f): | Written exam | | | |

**Syllabus**

*Aim.*: The aim of this university course is to teach students the fundamentals of analog electronics, focusing on signal amplification, semiconductor devices, and circuit analysis. Students will learn about the structure and operation of diodes, transistors (BJTs, JFETs, MOSFETs), and operational amplifiers, as well as how to design and analyze circuits using these components. The course covers both theoretical concepts and practical applications.

*Curriculum*: Basic concepts of analog signal amplification, operating characteristics, transfer characteristics, the appropriate equivalent circuit of an asymmetrical amplifier, linear two-port networks. Structure of semiconductors, current conduction in semiconductors, the P-N junction. Structure of a diode, its characteristics, biasing, and applications. The signal amplification process. Structure, operation, characteristics, and basic equations of a bipolar transistor. Structure, operation, and characteristics of field-effect transistors (JFET, MOSFET). Methods of biasing transistors, introduction to small-signal equivalent circuits of basic configurations. The principle of feedback. Definition of an operational amplifier, its structure (block diagram), equivalent circuit, properties of ideal and real operational amplifiers. Applications of operational amplifiers.

| Week | Topics |
|---|---|
| **1.** | Physical and electrochemical fundamentals of semiconductors, PN junctions. The structure and operation of the semiconductor diode. |
| **2.** | Bipolar and FET transistors, their structure and operation. |
| **3.** | Transistor biasing. |
| **4.** | 1st midterm exam. |
| **5.** | General amplifiers. |
| **6.** | Basic circuits of bipolar transistors. |
| **7.** | Basic circuits of FET transistors. |
| **8.** | 2nd midterm exam. |
| **9.** | Structure, operation, and characteristics of operational amplifiers. |
| **10.** | Basic configurations of operational amplifiers. |
| **11.** | Multistage amplifiers. |
| **12.** | Power electronics. |

| | |
|---|---|
| **13.** | 3rd midterm exam. |
| **14.** | Retake |

**Semester requirements:**
3 mid-term exam at least 40 points each, participation on the lectures.

**Method of the replacement:**
Attendance at the sessions is regulated by points (1)-(4) of §46 of the TVSZ. Retakes during the semester is regulated by points (7)-(9) of §47 of the TVSZ. The method for completing midterm grades/signatures after the end of the semester is governed by §3:8 of Chapter II, Part 1, Book Three of the Academic Regulations.

**Calculation of the midterm grade:**

- Maximum points on each mid-term exam: 100 points
- Minimum level: 40 points
- The final mark is calculated as the average of the 3 mid-term exams, (but at least 40 points on each is a minimum)
- Results, based on average point:
  - 2: 40 – 56
  - 3: 57 – 74
  - 4: 75 – 87
  - 5: 88 – 100

**Exam method:** written

**Literature:**


- Neamen, Donald A.: Semiconductor Physics and Devices: Basic Principles, 4th Edition (2012) McGraw-Hill Education ISBN: 978-0073529585
- Tony R. Kuphaldt: Lessons In Electric Circuits, Volume II– AC, 6th Edition, https://www.ibiblio.org/kuphaldt/electricCircuits/AC/AC.pdf
- Boylestad, Robert L., & Nashelsky, Louis: Electronic Devices and Circuit Theory, 11th Edition (2012), ISBN: 978-0132622264