# GAU, Faculty of Engineering

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| **Course Unit Title** | Electronic Circuits II |
| **Course Unit Code** | EEN302 |
| **Type of Course Unit** | Compulsory, Electrical and Electronics Engineering |
| **Level of Course Unit** | 3rd Year BSc |
| **National Credits** | 4 |
| **Number of ECTS Credits Allocated** | 7 ECTS |
| **Theoretical (hour/week)** | 3 |
| **Practice (hour/week)** | - |
| **Laboratory (hour/week)** | 2 |
| **Year of Study** | 3 |
| **Semester when the course unit is delivered** | 6 |
| **Mode of Delivery** | Face to Face, Experiments, E-learning activities |
| **Language of Instruction** | English |
| **Prerequisities and co-requisities** | EEN301 Electronic Circuits I |
| **Recommended Optional Programme Components** | Basic background of Circuit Theory |

**Objectives of the Course:**

- Teaching frequency and pulse responses of amplifiers
- Teaching basic feedback theory and stability issues of feedback amplifiers
- Teaching oscillator circuits

**Learning Outcomes**

| When this course has been completed the student should be able to | | Assessment |
|---|---|---|
| 1 | draw Bode plots of a given s-domain transfer function | 1,2,3 |
| 2 | determine pole and zero frequencies (low frequency response) of an amplifier due to coupling and bypass capacitances | 1,2 |
| 3 | determine pole and zero frequencies (high frequency response) of an amplifier due to parasitic capacitances | 1,2 |
| 4 | determine type of feedback and conduct relevant analyses | 1,2 |
| 5 | reveal the stability properties of a feedback via proper techniques | 1,2 |
| 6 | design sine-wave and square-wave oscillators | 1,2 |
| 7 | test low- and high-frequency responses of amplifiers and operation of oscillators via measurements | 3,5 |

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5 Lab. Work

**Course's Contribution to Program**

| | | CL |
|---|---|---|
| 1 | Ability to understand and apply knowledge of mathematics, science, and engineering | 5 |
| 2 | Ability to design and conduct experiments as well as to analyze and interpret data | 5 |
| 3 | Ability to work in multidisciplinary teams while exhibiting professional responsibility and ethical conduct | 2 |
| 4 | Ability to apply systems thinking in problem solving and system design | 4 |
| 5 | Knowledge of contemporary issues while continuing to engage in lifelong learning | 2 |
| 6 | Ability to use the techniques, skills and modern engineering tools necessary for engineering practice | 5 |
| 7 | Ability to express their ideas and findings, in written and oral form | 4 |
| 8 | Ability to design and integrate systems, components or processes to meet desired needs within realistic constraints | 5 |
| 9 | Ability to approach engineering problems and effects of their possible solutions within a well structured, ethically responsible and professional manner | 3 |
| 10 | Strong foundation on the fundamentals of Electrical and Electronics Engineering such as Circuit Theory, Signals, Systems, Control and Communications, which are necessary for successful practice in the field | 5 |
| 11 | Awareness on the contemporary requirements, methods and applications of the Electrical and Electronics Engineering | 3 |

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5:Very High)

**Course Contents**

| Week | | Exams |
|---|---|---|
| 1 | Causes and effects of frequency-dependent behavior. | |
| 2 | Bode diagrams of s-domain transfer functions. | |
| 3 | Low frequency response of capacitively-coupled amplifiers: Effect of coupling and bypass capacitors. | |
| 4 | High frequency behavior: Parasitic capacitances of BJT and MOSFET, definition of the transition frequency $f_t$, small-signal high-frequency equivalent circuits of BJT and MOSFET. | |
| 5 | Miller's theorem. High frequency behavior of basic gain stages. | Quiz #1 |
| 6 | Broadband amplifiers: Definition of gain-bandwidth product. Cascode amplifier, differential amplifier. | |
| 7 | Basic definitions, negative and positive feedback; | |
| 8 | | Midterm |
| 9 | The effect of negative feedback on circuit performance parameters. | |
| 10 | Types of negative feedback. | |
| 11 | Stability of negative feedback amplifiers: | |
| 12 | Stability criteria: Bode and Nyquist diagrams. | Quiz #2 |
| 13 | Pulse response: Tilt, rise time, ringing. | |
| 14 | Barkhausen criterion, sinusoidal oscillators. Relaxation oscillators. | |
| 15 | | Final |

**Recommended Sources**

**Textbook:** R. Boylestad & L. Nashelsky, "Electronic Devices and Circuit Theory", 10th edition, Prentice Hall, 2008.

**Supplementary Material(s):** A. Sedra & K.C. Smith, "Microelectronic Circuits", 6th edition, Oxford University Press, 2010.

**Assessment**

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|---|---|---|
| Attendance | 5% | |
| Assignments | 10% | |
| Laboratory | 10% | |
| Midterm Exam | 20% | Written |
| Quizzes | 20% | |
| Final Exam | 35% | Written |
| Total | 100% | |

**ECTS Allocated Based on the Student Workload**

| Activities | Number | Duration (hour) | Total Workload(hour) |
|---|---|---|---|
| Hours per week (Theoretical) | 14 | 3 | 42 |
| Hours per week (Laboratory) | 14 | 2 | 28 |
| Pre-Lab work preparation before experiments | 5 | 3 | 15 |
| Presenting of observations and laboratory practices as report | 5 | 6 | 30 |
| Preparation of the homeworks | 5 | 5 | 25 |
| Quizzes | 2 | 11 | 22 |
| Midterm Examination | 1 | 17 | 17 |
| Final Exam | 1 | 22 | 22 |
| Total Workload | | | 201 |
| Total Workload/30 (h) | | | 6.7 |
| ECTS Credit of the Course | | | 7 |