# SYLLABUS[1]

## 1. Information about the program

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| **1.1** Higher education institution | Politehnica University Timisoara |
| **1.2** Faculty[2] / Department[3] | Electronics and Telecommunication/ Applied Electronics |
| **1.3** Chair | – |
| **1.4** Field of study (name/code[4]) | Inginerie Electronica si Telecomunicatii |
| **1.5** Study cycle | Bachelor |
| **1.6** Study program (name/code)/Qualification | Technologies and Systems for Telecommunications/20.20.10.100 |

## 2. Information about the discipline

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|---|---|---|---|---|---|---|---|
| **2.1** Name of discipline | | | Analog Integrated Circuits | | | | |
| **2.2** Coordinator (holder) of course activities | | | Prof.dr.ing. Isar Dorina | | | | |
| **2.3** Coordinator (holder) of applied activities [5] | | | Prof.dr.ing. Isar Dorina | | | | |
| **2.4** Year of study[6] | 2 | **2.5** Semester | 4 | **2.6** Type of evaluation | E | **2.7** Type of discipline | DD |

## 3. Total estimated time (hours / semester of didactic activities)

| | | | | | |
|---|---|---|---|---|---|
| **3.1** No. of hrs. / week | 4 , of which: | **3.2** course | 2 | **3.3** seminar/laboratory/ project/training | 1/1 |
| **3.4** Total no. of hrs. in the education curricula | 56 , of which: | **3.5** course | 28 | **3.6** applied activities | 28 |

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| **3.7** Distribution of time for individual activities related to the discipline | hrs. |
| Study using a manual, course materials, bibliography and lecture notes | 28 |
| Additional documentation in the library, on specialized electronic platforms and on the field | 2 |
| Preparation for seminars / laboratories, homeworks, assignments, portfolios, and essays | 9 |
| Tutoring | |
| Examinations | 3 |
| Other activities | |
| **Total hrs. of individual activities** | 42 |

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| **3.8 Total hrs. / semester**[7] | 98 |
| **3.9 No. of credits** | 4 |

## 4. Prerequisites (where applicable)

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1 The form corresponds to the Syllabus promoted by OMECTS 5703/18.12.2011 (Annex3).

2 The name of the faculty which manages the educational curriculum to which the discipline belongs.

3 The name of the department entrusted with the discipline, and to which the course coordinator / holder belongs.

4 Fill in the code provided in GD no. 493/17.07.2013.

5 The applied activities refer to: seminar (S) / laboratory (L) / project (P) / practice/training (Pr).

6 The year of study to which the discipline is provided in the curriculum.

7 It is obtained by summing up the number of hrs. from 3.4 and 3.7.

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| **4.1** Curriculum | • Electrical Circuits, Electronic Devices, Computer Aided Design |
| **4.2** Competencies | • The use of standard laboratory equipment: DC power supply, multimeter, function generator, oscilloscope. |

## 5. **Conditions** (where applicable)

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| **5.1** of the course | • |
| **5.2** to conduct practical activities | • |

## 6. **Specific competencies acquired**

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|---|---|
| Professional competencies[8] | • Hardware applications for analog integrated circuits using test boards.<br>• Analyse the operation of many complex analog circuits using simulations.<br>• Design and test analog systems using analog integrated circuits.<br>• |
| Transversal competencies | • For each experiment there are teams of maximul 3 students, so each student must contribute and cooperate to complete the experiments. The Romanian students have to cooperate with Erasmus foreign students. |

## 7. **Objectives of the discipline** (based on the grid of specific competencies acquired)

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|---|---|
| **7.1** General objective of the discipline | • Develop the skills to analyse analog electronic circuits and systems as well as interpret experimental results.<br>• Develop a better understanding of the theory of analog integrated circuits through practical examples and testing. |
| **7.2** Specific objectives | • In the experimental laboratory, the student will gain experience designing and implementing current sources, differential stages, filters, comparators and op amp applications and comparing the operation to simulated performance using the SPICE program. |

## 8. **Content**

| **8.1** Course | No. of hours | Teaching methods |
|---|---|---|
| Introduction. Analog IC development, classification and technologies | 2 | Lectures are based on PowerPoint slides. |
| Multiple-Transistor Amplifier Stages. The CC-CE, CC-CC, and Darlington | 2 | If necessary, I use chalk for writing on |

[8] The professional competencies and the transversal competencies will be treated according to the Methodology of OMECTS 5703/18.12.2011. The competencies listed in the National Register of Qualifications in Higher Education [Registrul Naţional al Calificărilor din Învăţământul Superior RNCIS] (http://www.rncis.ro/portal/page?_pageid=117,70218&_dad=portal&_schema=PORTAL) will be used for the field of study from 1.4 and the program of study from 1.6 of this form, involving the discipline.

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|---|---|---|
| Configurations | | blackboards. |
| Differential Pairs. Small-Signal Analysis of Differential Amplifiers. | 4 | Students are encouraged to initiate and participate to course discussions . |
| Device Mismatch Effects in Differential Amplifiers. | 2 | Once a week we can organize a meeting in order to answer the student questions. |
| Current Mirrors. | 2 | |
| Active Loads. Differential Pair with Current-Mirror Load. | 2 | |
| Current References. Supply-Insensitive Biasing. | 2 | |
| Temperature-Insensitive Biasing. Band-Gap-Referenced Bias Circuits in Bipolar Technology. | 2 | |
| Op Am with Single-Ended Outputs. Linear Analog operations. | 2 | |
| Op Amp with Single-Ended Outputs. Nonlinear Analog Operations. | 1 | |
| Nonlinear Analog Circuit. Precision Rectification. Precision Peak Rectifiers | 2 | |
| Instrumentation amplifiers. Comparators. Negative Impedance Converter – NIC | 2 | |
| DC regulated power supply | 2 | |
| Deviations from Ideality in Real Operational Amplifiers. | 1 | |

Bibliography[9] In electronic format:1. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis and design of analog integrated circuits, fourth edition , JOHN WILEY & SONS, INC.

2. Isar Dorina – lecture notes and slides, course presentation in pdf format: https://intranet.etc.upt.ro/~AIC/COURSE/

In print:

1. Lucian Jurca, Mircea Ciugudean, Circuite integrate analogice, Editura "Politehnica", Timişoara, 2007, 2014

2. Paul R. Gray, Robert G. Meyer, Circuite integrate analogice. Analiza si proiectare. Traducere - prof. Mircea Bodea, Ed. Tehnica Bucuresti, 1983, 1993, 1999.

| **8.2** Applied activities[10] | No. of hours | Teaching methods |
|---|---|---|
| Using OrCAD–PSPICE | 2 | Laboratory experiments provide opportunities for students to learn through hands-on use of disciplinary tools and |

[9] At least one title must belong to the department staff teaching the discipline, and at least 3 titles must refer to national and international works relevant for the discipline, and which can be found in the Politehnica University Library.

[10] The types of applied activities are those specified in footnote 5. If the discipline contains several types of applied activities, then these will be written consecutively in the lines of the table below. The type of activity will be written in a distinct line, as „Seminar:", „Laboratory:", „Project:" and/or „Practice/Training:".

| | | |
|---|---|---|
| | | techniques. |
| BJT differential amplifier | 2 | |
| Operational amplifier basics | 2 | |
| The precision rectifier with operational amplifier. | 2 | |
| Dynamic behavior of operational amplifiers | 2 | |
| Multiple feedback band-pass filter. Test. | 4 | |
| Problem solving (current sources, differential stage and AO). Test. | 14 | Semiar classroom focuses on solving problems about analog circuits and op amp applications and it is an ongoing dialog with the students. |
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| | | |
| Bibliography [11] AIC Laboratory experiments : https://intranet.etc.upt.ro/~AIC/EXPERIMENTS/ | | |

**9. Corroboration of the content of the discipline with the expectations of the main representatives of the epistemic community, professional associations and employers in the field afferent to the program**

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**10. Evaluation**

| Type of activity | **10.1** Evaluation criteria | **10.2** Evaluation methods | **10.3** Share of the final grade |
|---|---|---|---|
| **10.4** Course | Written examination consisting of 2 sections: theory questions (T) and problems (P). Each section has the same weight, 10 Marks. The final mark for the written exam is the mean, only if T>=5 and P>= 5. | Written exam. | 2/3 |
| **10.5** Applied activities | **S:** individual test | Written test consisting of a few problems, the | 1/6 |

[11] At least one title must belong to the staff teaching the discipline.

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| | | mark is denoted as S and must be >=5. | |
| | **L:** individual test | The student must record all the results and experiments in its lab notebook. At the end of each lab, the student should be able to explain the operation of the tested circuit.<br>The students' progress will be evalueted through Individual test of practical skills, the mark is denoted as L and must be >=5. | 1/6 |
| | **P:** | | |
| | **Pr:** | | |
| **10.6** Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified) | | | |
| • Minimum performance standard is when the mean(S,L) is 5 and the mean(T,P) is 5. | | | |

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|---|---|---|
| **Date of completion** | **Course coordinator** | **Coordinator of applied activities** |
| | **(signature)** | **(signature)** |
| 15.12.2016 | | |
| | ..... | ..... |
| **Head of Department** | **Date of approval in the Faculty Council**[12] | **Dean** |
| **(signature)** | | **(signature)** |
| ..... | | ..... |

[12] Avizarea este precedată de discutarea punctului de vedere al board-ului de care aparţine programul de studiu cu privire la fişa disciplinei.