# SYLLABUS

## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Electronics, Telecommunications and Information Technology |
| 1.3 | Department | Applied Electronics |
| 1.4 | Field of study | Electronics and Telecommunications Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Telecommunications Technologies and Systems/ Engineer |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | TST-E108.00 |

## 2. Data about the subject

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | | | Data Acquisition Systems | | | | | |
| 2.2 | Subject area | | | | | Electronics and Telecommunications Engineering | | | | | |
| 2.3 | Course responsible/lecturer | | | | | Senior lecturer Liviu Marin Viman, PhD eng. | | | | | |
| 2.4 | Teachers in charge of applications | | | | | Senior lecturer Liviu Marin Viman, PhD eng.<br>Lecturer Septimiu Pop, PhD eng.<br>Teaching assist. Mihai Daraban, PhD eng. | | | | | |
| 2.5 | Year of study | III | 2.6 | Semester | 2 | 2.7 | Assessment | Verif. | 2.8 | Subject category | DS/ FAC |

## 3. Estimated total time

| Year / Sem. | Subject name | No. of weeks | Course [hours/week] | Applications [hours/week] S | L | P | Course [hours/sem.] | Applications [hours/sem.] S | L | P | Indiv. study | TOTAL | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| III/II | Data Acquisition Systems | 14 | 2 | | 1 | 2 | 28 | | 14 | 14 | 22 | 78 | 3 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3.1 | Number of hours per week | 4 | 3.2 | of which, course | 2 | 3.3 | applications | 2 |
| 3.4 | Total hours in the curriculum | 56 | 3.5 | of which, course | 28 | 3.6 | applications | 28 |

| Individual study | Hours |
|---|---|
| Manual, lecture material and notes, bibliography | 14 |
| Supplementary study in the library, online and in the field | - |
| Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 4 |
| Tutoring | 2 |
| Exams and tests | 2 |
| Other activities | - |

| | | |
|---|---|---|
| 3.7 | Total hours of individual study | 22 |
| 3.8 | Total hours per semester | 78 |
| 3.9 | Number of credit points | 3 |

## 4. Pre-requisites (where appropriate)

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|---|---|---|
| 4.1 | Curriculum | |
| 4.2 | Competence | Electronic Devices and Circuits, Data Acquisition Systems Fundamentals, Microcontrollers, Sensors and Transducers |

## 5. Requirements (where appropriate)

| | | |
|---|---|---|
| 5.1 | For the course | Amphitheatre, Cluj-Napoca |
| 5.2 | For the applications | Laboratory, Cluj-Napoca |

## 6. Specific competences

| | | |
|---|---|---|
| Professional competences | Theoretical knowledge (what the student must know): | - The design of the structure and the components of a data acquisition system, according to the required application.<br>- To deeply understand the basics of Data Acquisition Systems / Industrial Systems, in order to integrate them correctly and efficiently into Data logger systems.<br>- To understand the errors and limits sources and apply methods for reducing the unwanted effects |
| | Acquired skills (what the student is able to do): | After completing the discipline, the students will be able to:<br>- define a data acquisition system;<br>- develop required specifications depending on the application;<br>- create a structure of a data acquisition system;<br>- develop specifications for the functional blocks;<br>- design the functional blocks of data acquisition system;<br>- realized the hardware test and the calibration of the system;<br>- use the data acquisition system;<br>- functional analyzing and performances of data acquisition system;<br>- defined/created the soft applications of of data acquisition system. |
| | Acquired abilities: (what type of equipment the student is able to handle) | After completing the discipline, the students will be able to:<br>- use LabVIEW, LabVIEW FPGA;<br>- use FPGA circuits and systems where are included. |
| | In accordance with Grila1 and Grila2 RNCIS | N.A. |
| Cross competences (Grila1 and Grila2 RNCIS) | | N.A. |

## 7. Discipline objectives (as results from the key competences gained)

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|---|---|---|
| 7.1 | General objectives | Developing skills regarding analysis and design of the data acquisition systems |
| 7.2 | Specific objectives | 1. Assimilation of theoretical knowledge on the functioning and performances of the support circuits for DAC and ADC.<br>2. Obtaining the necessary skills to: develop, designing (and computer aided design) and analyze the data acquisition systems. |

## 8. Contents

| 8.1. Lecture (syllabus) | | Teaching methods | Notes |
|---|---|---|---|
| 1 | Defining a Data Acquisition System. Specific Parameters. | Presentation, heuristic conversation, exemplification, teaching exercise, case study, formative evaluation | Use of .ppt presentation, projector, blackboard |
| 2 | Adapting the Data Acquisition System to the required application. | | |
| 3 | Data Acquisition System Structure. Informational path. | | |
| 4 | Intermediate data processing. | | |
| 5 | Specifying the structural blocks. | | |
| 6 | Performance / structure / price ratio. | | |
| 7 | Conditioning stages design. | | |
| 8 | ADC design. | | |
| 9 | Embedded system design. | | |
| 10 | DAC and output amplifiers design. | | |
| 11 | Communication paths. Distributed Data Acquisition System. | | |
| 12 | Block and system calibration. Functional and performance analyzis. | | |
| 13 | Data Acquisition System software component. | | |
| 14 | Recapitulation. Preparation for the final exam. | | |
| 8.2. Applications (project) | | Teaching methods | Notes |
| 1 | Defining a Data Acquisition System. Specific Parameters. | Presentation, exemplification, case study, formative evaluation | |
| 2 | Data Acquisition System Structure. Informational path. | | |
| 3 | Conditioning stages design. | | |
| 4 | Variable gain amplifiers ADC design. | | |
| 5 | Embedded system design. | | |
| 6 | Processing and displaying data. | | |
| 7 | Project presentation. | | |
| 8.3. Applications (lab.) | | Teaching methods | Notes |
| 1 | General presentation of LabVIEW FPGA and SPARTAN-3E Starter Kit board | Didactic and experimental proof, didactic exercise, team work | Use of laboratory instrumentation, experimental boards, computers |
| 2 | LabVIEW FPGA project implementation . | | |
| 3 | Events counter for the rotary encoder. | | |
| 4 | T1. Digital thermometer. (test) | | |
| 5 | T2. Signal generator. (test) | | |
| 6 | T3. LCD controller. (test) | | |
| 7 | Lab recovery and finalization of laboratory activity | | |

### Bibliography

1. M. Dăbâcan – Data Acquisition Systems Fundamentals, Casa Cărţii de Ştiinţă, ISBN 973-686-566-5, 295 pagini, Cluj-Napoca, 2004.
2. Liviu Viman, Septimiu Pop – Data acquisition systems – Applications development with LabVIEW FPGA and Spartan-3E Starter Kit Board, Cluj-Napoca, Romania: U.T.PRESS, 2015, ISBN: ?, 97p – under printing.
3. Jack Ganssle et al. – Embedded Hardware: Know It All, Newnes, ISBN: 978-0-7506-8584-9, 2008.
4. Robert Oshana, Mark Kraeling – Software Engineering for Embedded Systems – Methods Practical Techniques and Applications, Elsevier, ISBN: 978-0-12-415917-4, 2013.

### On-line references

1. L. Viman, S. Pop - "Data Acquisition Systems – Lab Themes ", UTCN, site: http://www.ael.utcluj.ro/ORGANIZARE/curs_SAD.HTML , 60 pagini, Cluj-Napoca, 2009.

## 9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

Competences acquired will be used in the following COR occupations (Electronics Engineer; Telecommunications Engineer; Electronics Design Engineer; System and Computer Design Engineer; Communications Design Engineer) or in the new occupations proposed to be included in COR (Sale Support Engineer; Multimedia Applications Developer; Network Engineer; Communications Systems Test Engineer; Project Manager; Traffic Engineer; Communications Systems Consultant).

## 10. Evaluations

| Activity type | 10.1 | Assessment criteria | 10.2 | Assessment methods | 10.3 | Weight in the final grade |
|---|---|---|---|---|---|---|
| Course | | The level of acquired theoretical knowledge and practical skills | | Summative evaluation written exam (E) | | 40% |
| Applications | | The level of acquired abilities | | practical lab test (T1, T2, T3) | | 30% |
| Project | | The level of acquired abilities | | P | | 30% |
| 10.4 Minimum standard of performance | | | | | | |
| L≥5 (L=(T1+T2+T3)/3) and P≥5 and E≥4 and NF≥4.5 where NF=0.3*L +0.3*P+ 0.4*E. | | | | | | |

Date of filling in
26.01.2015

Course responsible
Assist. Prof. Liviu Viman, PhD

Teachers in charge of applications
Assist. Prof. Septimiu Pop, PhD

Date of approval in the department
26.01.2015

Head of department
Prof. Dorin Petreus, PhD