SYLLABUS[1]

1. Information about the program

1.1 Higher education institution	University Politehnica Timisoara
1.2 Faculty[2] / Department[3]	Faculty of Electronics and Telecommunications/Measurements and Optical Electronics Department
1.3 Chair	—
1.4 Field of study (name/code[4])	Electronics Engineering and Telecommunications
1.5 Study cycle	License
1.6 Study program (name/code)/Qualification	Technologies and Telecommunications Systems

2. Information about the discipline

2.1 Name of discipline			Modelling and Simulation				
2.2 Coordinator (holder) of course activities			Lecturer Raul Ciprian IONEL				
2.3 Coordinator (holder) of applied activities [5]			Lecturer Raul Ciprian IONEL				
2.4 Year of study[6]	4	**2.5** Semester	1	**2.6** Type of evaluation	Exam	**2.7** Type of discipline	Mandatory

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	2
3.4 Total no. of hrs. in the education curricula	56 , of which:	**3.5** course	28	**3.6** applied activities	28
3.7 Distribution of time for individual activities related to the discipline					hrs.
Study using a manual, course materials, bibliography and lecture notes					10
Additional documentation in the library, on specialized electronic platforms and on the field					7
Preparation for seminars / laboratories, homeworks, assignments, portfolios, and essays					10
Tutoring					10
Examinations					10
Other activities project coordination and discussions with students about project details					10
Total hrs. of individual activities					57

3.8 Total hrs. / semester[7]	113
3.9 No. of credits	5

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.

4.1 Curriculum	• **Basic modelling and simulation concepts.** Continuous-time systems, discrete-time systems, the mathematical model, modelling and simulation approaches, correspondence between electrical and other physical systems MATLAB, LabView and NI Multisim introduction. **State space models:** introduction, state space model calculations, practical examples involving filters, correspondence with the mathematical model. **Using the Laplace transform:** introduction, poles and zeros, transfer functions models, program implementation of transfer functions, conversion between state space models and transfer functions. **Circuit transformations:** Conversion between time and frequency domains, examples and results comparison, eigenvalues, zeros-poles models and stability analysis. **Frequency and time response analysis:** program implementation of power gain, amplitude gain and phase calculations, filter characteristics, general form of Bode plots, step response, impulse response.
4.2 Competencies	• Methodical analysis of activity related problems. Using specialized software and electronic resources written in English. Using fundamental elements related to devices, circuits, systems and electronic instrumentation and technology.

5. **Conditions** (where applicable)

5.1 of the course	•
5.2 to conduct practical activities	•

6. **Specific competencies acquired**

Professional competencies[8]	• Applying knowledge, concepts and basic methods related to circuits and electronic instrumentation, programming techniques and languages.
Transversal competencies	• Adapting to new technologies, professional and personal development, by continuous study using printed documentation resources, specialized software and electronic resources available in an international language.

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

7.1 General objective of the discipline	• Problem solving using MATLAB, LabView and NI Multisim. State space models calculations. Implementation using graphical and text programming. Comparison between graphical and text programming implementation possibilities. State space to transfer function

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 Național al Calificărilor din Învățământul 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.

	transformations. Rotational antenna dish positioning system example. Transfer Function models. Zero – Pole – Gain models. State – Space models. Conversion between model forms. Conversion between continuous and discrete models. • Building of filtering circuits and testing them using signal generators and oscilloscopes. Performance analysis and conclusions. The project includes circuit description, functionality, schematics, mathematical calculations and the stability study.
7.2 Specific objectives	• Study of **Basis modelling and simulation concepts, State space models, the Laplace transform, Circuit transformations, Frequency and time response analysis.**

8. Content

8.1 Course	No. of hours	Teaching methods
Basic modelling and simulation concepts	2	Theory/Simulation/Examples
Continuous-time systems, discrete-time systems	2	Theory/Simulation/Examples
The mathematical model, modelling and simulation approaches	2	Theory/Simulation/Examples
State space models	2	Theory/Simulation/Examples
State space model calculations	2	Theory/Simulation/Examples
Practical examples involving filters	2	Theory/Simulation/Examples
Correspondence with the mathematical model	2	Theory/Simulation/Examples
Using the Laplace transform	2	Theory/Simulation/Examples
Poles and zeros, transfer functions models	2	Theory/Simulation/Examples
Program implementation of transfer functions	2	Theory/Simulation/Examples
Circuit transformations	2	Theory/Simulation/Examples
Conversion between time and frequency domains	2	Theory/Simulation/Examples
Frequency and time response analysis	2	Theory/Simulation/Examples
Power gain, amplitude gain and phase calculations	2	Theory/Simulation/Examples

Bibliography[9]

R. Ionel, *Modelare si Simulare. Experimente si Aplicatii*, "Politehnica" Publisher, ISBN 978-606-554-315-7, Timisoara, 116 pages, 2011.

Gary W. Johnson, R. Jennings, *LabVIEW Graphical Programming*, McGraw – Hill Professional, 2006.

Jim Ledin, *Simulation Engineering*, CMP Books, R & D Developer Series, 2001, ISBN 1-57820-080-6.

Bernard Ziegler, Herbert Praehofer, Tag Gon Kim, *Theory of Modelling and Simulation*, Academic Press, 2000.

8.2 Applied activities[10]	No. of hours	Teaching methods
Laboratory:	14	Practical problem solving using LabVIEW, MATLAB and Multisim
Project:	14	Applications implementation

[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:".

		using LabVIEW, MATLAB and Multisim

Bibliography [11]

R. Ionel, *Modelare si Simulare. Experimente si Aplicatii*, "Politehnica" Publisher, ISBN 978-606-554-315-7, Timisoara, 116 pages, 2011.

Gary W. Johnson, R. Jennings, *LabVIEW Graphical Programming*, McGraw – Hill Professional, 2006.

Jim Ledin, *Simulation Engineering*, CMP Books, R & D Developer Series, 2001, ISBN 1-57820-080-6.

Bernard Ziegler, Herbert Praehofer, Tag Gon Kim, *Theory of Modelling and Simulation*, Academic Press, 2000.

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

- A study by National Instruments and Tektronix from 2005, entitled Integrating Design and Test, shows that all "best in class" companies use simulation before design implementation. The study confirms that simulation usage increases productivity by 29%. Other factors which have been discussed in this study and influence productivity increase are: design verification (40% influence), components evaluation (22% influence) and nets placement (8% influence).
- Institute for Printed Circuits, in 2008, shows that 75% of total costs for PCB construction are influenced by choices made during design stages. Important details about circuit functionality can be tested using modelling and simultaion, without actual implementation.

10. Evaluation

Type of activity	**10.1** Evaluation criteria	**10.2** Evaluation methods	**10.3** Share of the final grade
10.4 Course	Knowledge of discussed concepts	Written exam	66%
10.5 Applied activities	**S:**		
	L: Problem solving	Written Tests	16.5%
	P: Project implementation	Project evaluation	16.5%
	Pr:		

10.6 Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified)

- Understanding of concepts which the course focuses on. Knowledge is verified by written exam, written tests and project work.

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

Date of completion	Course coordinator (signature)	Coordinator of applied activities (signature)
	.....	.....

Head of Department (signature)	Date of approval in the Faculty Council[12]	Dean (signature)
.....		.....

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