

# SYLLABUS

## 1. Information about the program

1.1 Higher education institution	UNIVERSITY POLITEHNICA OF TIMISOARA
1.2 Faculty <sup>1</sup> / Department <sup>2</sup>	ELECTRONICS, TELECOMUNICATON AND INFORMATION TECHNOLOGIES/MEO
1.3 Field of study (name/code <sup>3</sup> )	ELECTRONIC ENGINEERING, TELECOMMUNICATION AND INFORMATION TECHNOLOGIES
1.4 Study cycle	License
1.5 Study program (name/code/qualification)	TST-ENG/20/20/10/100/10/TST-ENG

## 2. Information about the discipline

2.1 Name of discipline/ formative category <sup>4</sup>	Electromagnetic Compatibility/DD						
2.2 Coordinator (holder) of course activities	Conf. dr. ing. Andrei-Marius Silaghi						
2.3 Coordinator (holder) of applied activities <sup>5</sup>	Conf. dr. ing. Andrei-Marius Silaghi, As. drd. ing. Octavian Pacurar						
2.4 Year of study <sup>6</sup>	3	2.5 Semester	6	2.6 Type of evaluation	E	2.7 Regime of discipline <sup>7</sup>	DO

## 3. Total estimated time – hours / semester: direct teaching activities (fully assisted or partly assisted) and individual training activities (unassisted)<sup>8</sup>

3.1 Number of fully assisted hours / week	4 of which:	3.2 course	2	3.3 seminar / laboratory / project	0/2/0
3.1* Total number of fully assisted hours / semester	56 of which:	3.2* course	28	3.3* seminar / laboratory / project	0/28/0
3.4 Number of hours partially assisted / week	0 of which:	3.5 training	0	3.6 hours for diploma project elaboration	0
3.4* Total number of hours partially assisted / semester	0 of which:	3.5* training	0	3.6* hours for diploma project elaboration	0
3.7 Number of hours of unassisted activities / week	1.36 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			0.45
		hours of individual study after manual, course support, bibliography and notes			0.45
		training seminars / laboratories, homework and papers, portfolios and essays			0.46
3.7* Number of hours of unassisted activities / semester	19 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			6.3
		hours of individual study after manual, course support, bibliography and notes			6.3
		training seminars / laboratories, homework and papers, portfolios and essays			6.44
3.8 Total hours / week <sup>9</sup>	5.36				
3.8* Total hours /semester	75				
3.9 Number of credits	3				

## 4. Prerequisites (where applicable)

4.1 Curriculum	• Electrical Circuits, 1st year 2nd sem., Fundamentals of Electrical Engineering, 2nd
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<sup>1</sup> The name of the faculty which manages the educational curriculum to which the discipline belongs

<sup>2</sup> The name of the department entrusted with the discipline, and to which the course coordinator/holder belongs.

<sup>3</sup> The code provided in HG - on the approval of the Nomenclature of fields and specializations / study programs, annually updated.

<sup>4</sup> Discipline falls under the educational curriculum in one of the following formative disciplines: Basic Discipline (DF), Domain Discipline (DD), Specialist Discipline (DS) or Complementary Discipline (DC).

<sup>5</sup> Application activities refer to: seminar (S) / laboratory (L) / project (P) / practice/training (Pr).

<sup>6</sup> Year of studies in which the discipline is provided in the curriculum.

<sup>7</sup> Discipline may have one of the following regimes: imposed discipline (DI) or compulsory discipline (DOb)-for the other fundamental fields of studies offered by UPT, optional discipline (DO) or optional discipline (Df).

<sup>8</sup> The number of hours in the headings 3.1 \*, 3.2 \*, ..., 3.8 \* is obtained by multiplying by 14 (weeks) the number of hours in headings 3.1, 3.2, ..., 3.8. The information in sections 3.1, 3.4 and 3.7 is the verification keys used by ARACIS as: (3.1) + (3.4) ≥ 28 hours / wk. and (3.8) ≤ 40 hours / wk.

<sup>9</sup> The total number of hours / week is obtained by summing up the number of hours in points 3.1, 3.4 and 3.7.

	year 3rd sem., Measurements in Electronics and Telecommunications, 2nd year 3rd sem, Microwaves, 3rd year 5th sem.
4.2 Competencies	• Complex Analysis, General Electronics Practical Abilities

## 5. Conditions (where applicable)

5.1 of the course	<ul style="list-style-type: none"> <li>The course is taking place in a room adequate for the number of students, which fulfills standard regulations concerning space. Presentation is sustained by video projector, while proofs and problems are solved on whiteboard. Conditions for interactivity are met</li> </ul>
5.2 to conduct practical activities	<ul style="list-style-type: none"> <li>The laboratory activities are taking place in a room adequate for the number of students, which fulfills standard regulations concerning space. The activity is relying on a practical part consisting of multimeters, generators, oscilloscopes, measurement receivers, spectrum analyzers, coils, antennas etc. (four work groups are constituted)</li> </ul>

## 6. Specific competencies acquired through this discipline

Specific competencies	<ul style="list-style-type: none"> <li>Knowledge of EMC Testing equipment</li> <li>Knowledge of the electromagnetic coupling phenomena and shielding possibilities</li> <li>Knowledge of main antenna types and radiation mechanisms</li> <li>Knowledge of antenna parameters <ul style="list-style-type: none"> <li>Knowledge of Automotive EMC Standards</li> </ul> </li> <li></li> </ul>
Professional competencies ascribed to the specific competencies	<ul style="list-style-type: none"> <li>Use of fundamentals in terms of devices, circuits, systems, instrumentation and electronics technology</li> <li>Selection, installation, configuration and operation of fixed and mobile equipment and equipping a site with common telecommunication networks</li> <li>Solving technological problems in fields of applied electronics.</li> </ul>
Transversal competencies ascribed to the specific competencies	<ul style="list-style-type: none"> <li>Methodical analysis of field-related problems aimed at identifying acknowledged solutions, thus ensuring the accomplishment of professional tasks</li> <li>Adaptation to new technologies, professional and personal development through continuous training using printed documentation sources, specialized software and electronic resources in Romanian and at least one foreign language</li> </ul>

## 7. Objectives of the discipline (based on the grid of specific competencies acquired - pct.6)

7.1 The general objective of the discipline	<ul style="list-style-type: none"> <li>The course acquaints the students with specific problems concerning compliance with electromagnetic compatibility regulations, measurement and testing standards. Regulations concerning the emissions perturbations level and immunity tests for electronic equipment are presented. The discipline assures competence in electromagnetic compatibility regulations implementation, necessary to every electronic engineer for designing, building and using electronic equipment.</li> </ul>
7.2 Specific objectives	<ul style="list-style-type: none"> <li>At the end of the course, the students will know details about sources of disturbances, coupling mechanisms, and how to avoid them, the theory of electromagnetic screens and techniques related to shielded and anechoic chambers, and also the principles regarding EMC design of products</li> </ul>

## 8. Content <sup>10</sup>

8.1 Course	Number of hours	Teaching methods <sup>11</sup>
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<sup>10</sup> It details all the didactic activities foreseen in the curriculum (lectures and seminar themes, the list of laboratory works, the content of the stages of project preparation, the theme of each practice stage). The titles of the laboratory work carried out on the stands shall be accompanied by the notation "(\*)".

Introduction to EMC. Conducted Emissions – LISN, power supply filters	5	Lectures based on PowerPoint presentations sustained by whiteboard calculations and interaction with auditory by Q&A sessions
Testing instrumentation - Spectrum analyzer	2	
Testing instrumentation - Measurement receiver (detectors)	2	
Electromagnetic couplings (capacitive, inductive, common impedance, radiated)	3	
Conducted Immunity (types of test impulses and generators)	2	
Antenna parameters	2	
Radiated Emissions (electric and magnetic field antennas)	2	
Radiated Immunity	2	
Automotive EMC Standards (CISPR 25, ISO 11452)	4	
Hardware PCB Design for EMC	4	
Bibliography <sup>12</sup> Andrei-Marius Silaghi, Electromagnetic Compatibility, Lecture Notes available on Virtual Campus, 2021, cv.upt.ro (in English) Video recordings on Virtual Campus cv.upt.ro A. Schwab, <i>Electromagnetic Compatibility</i> , București: AGIR, 2013 (in Romanian translated from German) C. R. Paul, <i>Introduction to Electromagnetic Compatibility: Second Edition.</i> , JOHN WILEY & SONS, INC., New Jersey 2006. H. W. Ott, <i>Electromagnetic Compatibility Engineering</i> , John Wiley & Sons, Inc., Hoboken, New Jersey, 2009		
<b>8.2 Applied activities</b> <sup>13</sup>	Number of hours	Teaching methods
Introduction to decibels; cables and generator specification - exercises	4	Exercises and Experimental demonstrations and hands-on
Measurement receiver - laboratory	2	
Spectrum analyzer – laboratory	2	
Measurement of magnetic induction - laboratory	2	
Components + antennas - exercises	4	
Conducted emissions – laboratory + exercises	4	
Radiated emissions – laboratory + exercises	4	
Test – laboratory + exercises	4	
Practical demonstrations in the industry at EMC Laboratory Continental Timisoara	2	
Bibliography <sup>14</sup> A. Silaghi, C. Iftode, " <i>Electromagnetic Compatibility. Experiments</i> ", Ed. Orizonturi Universitare, Timisoara, 2020. Laboratory works (text) and video presentations on the Virtual Campus (in English) cv.upt.ro, 2021		

### 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

- The EMC discipline responds to the development of electrical, electronic and communication equipment, which has led to the increase of desired and non -desired interaction between equipment. There are collaborations with engineers from the EMC Laboratory from Continental SA Timisoara

### 10. Evaluation

Type of activity	10.1 Evaluation criteria <sup>15</sup>	10.2 Evaluation methods	10.3 Share of the final grade
10.4 Course	Ability to answer theoretical questions	Written Examination	50%

<sup>11</sup> Presentation of the teaching methods will include the use of new technologies (e-mail, personalized web page, electronic resources etc.).

<sup>12</sup> At least one title must belong to the discipline team and at least one title should refer to a reference work for discipline, national and international circulation, existing in the UPT library.

<sup>13</sup> Types of application activities are those specified in footnote 5. If the discipline contains several types of applicative activities then they are sequentially in the lines of the table below. The type of activity will be in a distinct line as: "Seminar:", "Laboratory:", "Project:" and / or "Practice/training".

<sup>14</sup> At least one title must belong to the discipline team.

<sup>15</sup> Syllabus must contain the procedure for assessing the discipline, specifying the criteria, methods and forms of assessment, as well as specifying the weightings assigned to them in the final grade. The evaluation criteria shall be formulated separately for each activity foreseen in the curriculum (course, seminar, laboratory, project). They will also refer to the forms of verification (homework, papers, etc.)

<b>10.5</b> Applied activities	<b>S:</b>		
	<b>L:</b> Ability to handle electromagnetic compatibility equipment and to solve specific exercises	Written test with exercises and written test with laboratory measurements	50%
	<b>P<sup>16</sup>:</b>		
	<b>Pr:</b>		
<b>10.6</b> Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified <sup>17</sup> )			
<ul style="list-style-type: none"> <li>• 5 for course exam and 5 for activity grade</li> </ul>			

**Date of completion**

21.06.2023

**Course coordinator  
(signature)**

**Coordinator of applied activities  
(signature)**

**Head of Department  
(signature)**

**Date of approval in the Faculty Council <sup>18</sup>**

14.09.2023

**Dean  
(signature)**

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<sup>16</sup> In the case where the project is not a distinct discipline, this section also specifies how the outcome of the project evaluation makes the admission of the student conditional on the final assessment within the discipline.

<sup>17</sup> It will not explain how the promotion mark is awarded.

<sup>18</sup> The endorsement is preceded by the discussion of the board's view of the study program on the discipline record.