SYLLABUS

1. Information about the program

1.1 Higher education institution	Universitatea Politehnica Timișoara
1.2 Faculty[1] / Department[2]	ELECTRONICS, TELECOMMUNICATIONS AND INFORMATION TECHNOLOGIES / Applied Electronics Department
1.3 Field of study (name/code[3])	Electronics, Telecommunications and Information Technologies Engineering /20/20/10
1.4 Study cycle	Master
1.5 Study program (name/code/qualification)	AUTOMOTIVE ELECTRONIC SYSTEMS/ 20/20/10 / 2152

2. Information about discipline

2.1a Name of discipline/The educational classe[4]	Low Power Electronic Systems/DF						
2.1b Name of discipline in Romanian	Sisteme cu consum redus						
2.2 Coordinator (holder) of course activities	Associate Professor Dr. Eng Adrian Popovici.						
2.3 Coordinator (holder) of applied activities[5]	Associate Professor Dr. Eng. Adrian Popovici						
2.4 Year of study[6]	2	**2.5** Semester	3	**2.6** Type of evaluation	V	**2.7** Regime of discipline[7]	DOP

3. Total estimated time (direct activities (fully assisted), partially assisted activities and unassisted activities[8])

3.1 Number of hours fully assisted/week	4 ,of which:	course	2	seminar/laboratory/project			2
3.1* Total number of hours fully assisted/sem.	56 ,of which:	course	28	seminar/laboratory/project			28
3.2 Number of on-line hours fully assisted/sem	32 ,of which:	course	16	seminar/laboratory/project			16
3.3 Number of hours partially assisted/week	,of which:	project, research		training		hours designing M.A. dissertation	
3.3* Number of hours partially assisted/ semester	,of which:	project of research		training		hours designing M.A. dissertation	
3.4 Number of hours of unassisted activities/ week	4.93 ,of which:	Additional documentation in the library, on specialized electronic platforms, and on the field					1.43
		Study using a manual, course materials, bibliography and lecture notes					1.5
		Preparation of seminars/ laboratories, homework, assignments, portfolios, and essays					2
3.4* Total number of hours of unasssited asctivities/ semester	69 ,of which:	Additional documentation in the library, on specialized electronic platforms, and on the field					20
		Study using a manual, course materials, bibliography and lecture notes					21
		Preparation of seminars/ laboratories, homework, assignments, portfolios, and essays					28
3.5 Total hrs./week[9]	8.93						
3.5* Total hrs./semester	125						
3.6 No. of credits	5						

4. Prerequisites (where applicable)

4.1 Curriculum	•
4.2 Learning outcomes	•

5. Conditions (where applicable)

5.1 of the course	• Room with a minimum of 30 seats, equipped with a projector and internet access
5.2 to conduct practical activities	• In accordance with activity completion requirements

6. **Learning outcomes** acquired through this discipline

Knowledge	• C1. The student/graduate demonstrates advanced knowledge of the categories of electronics, the principles of electricity and engineering, and the physics and mathematics required for the design and analysis of complex electronic systems. • C2. The student/graduate explains concepts and methods of research and industrial development applicable to electronics, including applied mechanics, testing methods for electrical equipment, and procedures for testing electronic components and systems. • C8. The student/graduate describes procedures for developing sketches and technical documentation for the design and validation of monitoring equipment. • C13. The student/graduate demonstrates advanced knowledge of power electronics principles, conversion circuits, and their applications in industrial and energy systems. • C14. The student/graduate explains methods and techniques for modeling power electronic systems, including the analysis of components and their interactions.
Skills	• A1. The student/graduate approves engineering projects, applying quality standards, technical regulations, and sustainability criteria. • A2. The student/graduate conducts scientific research in electronics, developing innovative methods and solutions for circuits, semiconductors, and advanced technological applications. • A3. The student/graduate designs electronic systems, including circuits, equipment, and applications in fields such as automotive and instrumentation. • A4. The student/graduate prepares technical reports and project documentation, integrating testing data, comparative analyses, and implementation recommendations. • A5. The student/graduate drafts technical reports and project documentation in compliance with engineering standards.
Responsibility and autonomy	• RA1. The student/graduate assumes responsibility for coordinating and approving engineering projects, assessing the technical, economic, and environmental impact of proposed solutions. • RA5. The student/graduate assumes responsibility for preparing and communicating technical reports to stakeholders. • RA6. The student/graduate engages in lifelong learning, continuously updating competences in line with scientific and technological progress. • RA9. The student/graduate coordinates multidisciplinary teams for the design, implementation, and testing of monitoring systems. • RA13. The student/graduate coordinates and contributes to research and development teams, fostering collaboration and knowledge exchange..

7. **Objectives of the discipline** (based on the grid of learning outcomes acquired)

- The course provides fundamental theoretical and practical knowledge on optimizing electronic systems in order to minimize energy consumption.
- Presentation of specific methods for managing and reducing the energy consumed by electronic circuits.
- Implementation of specific methods for managing and reducing the energy consumed by electronic circuits.
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8. **Content**

8.1 Course	Number of hours	Of which online	Teaching methods
Introduction to the design of low-power electronic systems	2		Presentation, lecture,

Reusing known concepts for designing low-power circuits	2		conversation, explanation, example, presentation slides, demonstrations, discussions with students.
Analysing and estimating energy consumption in digital systems	2		
Modelling energy losses in CMOS transistors	2		
Generic estimation of energy consumption	2	2	
Analyse energy consumption at the algorithm level.	2	2	
Practical methods for reducing energy consumption in digital systems	2	2	
Power management in power supply circuits. Design approaches and specifications.	2	2	
DC-DC conversion techniques used in low-power systems .	2	2	
Specifying power requirements for low-power digital systems	2	2	
Sequential activation of power supplies	2	2	
The "latchup" effect in sequential power supply of CMOS circuits	2	2	
Control of conexion sequences and monitoring of power supplies with multiple outputs	2		
Power supplies with multiple outputs	2		

Bibliography[10]

Goran S. Jovanović, Delay locked loop clock generator in low power VLSI IC design, Buletinul ştiinţific al Universităţii „Politehnica” din Timişoara, România. Seria automatică şi calculatoare Vol. 56(70), no. 4 (2011), p. 131-136 56:4<131 56323

Christian Piguet, Low-power electronics design, CRC Press, 2005, ISBN : 0849319412

Edgar Sánchez-Sinencio, Low-voltage/low-power integrated circuits and systems: low-voltage mixed-signal circuits, New York IEEE Press, 1999, ISBN : 9780470545065

A Popovici, Low Power Electronic Systems, Campus Virtual UPT, 2025

Jacek Korec, Low Voltage Power MOSFETs Design, Performance and Applications, ISBN 978-1-4419-9319-9 e-ISBN 978-1-4419-9320-5, DOI 10.1007/978-1-4419-9320-5, Springer New York Dordrecht Heidelberg London, 2011

Jan Rabaey, Low Power Design Essentials, Department of Electrical Engineering & Computer Science (EECS) University of California, Berkeley, USA, Springer ScienceþBusiness Media, ISSN 1558-9412, ISBN 978-0-387-71712-8 e-ISBN 978-0-387-71713-5 DOI 10.1007/978-0-387-71713-5LLC 2009

Michiel Steyaert, Arthur van Roermund, Low Voltage Low Power; Short Range Wireless Front-Ends; Power Management and DC-DC, ISBN 978-94-007-1925-5 e-ISBN 978-94-007-1926-2, DOI 10.1007/978-94-007-1926-2 Springer Dordrecht Heidelberg London New York, 2012

Patrick Girard, Power-Aware Testing and Test Strategies for Low Power Devices, ISBN 978-1-4419-0927-5 e-ISBN 978-1-4419-0928-2 DOI 10.1007/978-1-4419-0928-2 Springer New York Dordrecht Heidelberg London, 2010

Xi Zhang, Vehicle Power Management Modeling, Control and Optimization, ISSN 1612-1287 e-ISSN 1860-4676 ISBN 978-0-85729-735-8 e-ISBN 978-0-85729-736-5 DOI 10.1007/978-0-85729-736-5, Springer London Dordrecht Heidelberg New York, 2011

Nihal Kularatna, DC Power Supplies Power Management and Surge Protection for Power Electronic Systems, CRC Press Taylor & Francis Group, 2012

Naser Khosro Pour, François Krummenacher and Maher Kayal, Electronics for Power and Energy Management, February 12th 2014, DOI: 10.5772/57281, www.intechopen.com/books/ict-energy-concepts-towards-zero-power-information-and-communication-technology/electronics-for-power-and-energy-management, 2014

	Haruo Kobayashi, Takashi Nabeshima, Handbook Power Management Circuits, CRC Press Taylor & Francis Group, International Standard Book Number-13: 978-981-4613-16-3, 2016

8.2 Applied activities[11]	Number of hours	Of which online	Teaching methods
Low Power Electronic Systems laboratory specific activities	28	16	Conversation, explanation, example, demonstration, comparative analysis, case study, brainstorming.

	Bibliography[12] Goran S. Jovanović, Delay locked loop clock generator in low power VLSI IC design, Buletinul ştiinţific al Universităţii „Politehnica" din Timişoara, România. Seria automatică şi calculatoare Vol. 56(70), no. 4 (2011), p. 131-136 56:4<131 56323 Christian Piguet, Low-power electronics design, CRC Press, 2005, ISBN : 0849319412 Edgar Sánchez-Sinencio, Low-voltage/low-power integrated circuits and systems: low-voltage mixed-signal circuits, New York IEEE Press, 1999, ISBN : 9780470545065 Jacek Korec, Low Voltage Power MOSFETs Design, Performance and Applications, ISBN 978-1-4419-9319-9 e-ISBN 978-1- 4419-9320-5, DOI 10.1007/978-1-4419-9320-5, Springer New York Dordrecht Heidelberg London, 2011 A Popovici, Low Power Electronic Systems, Campus Virtual UPT, 2025 Jan Rabaey, Low Power Design Essentials, Department of Electrical Engineering & Computer Science (EECS) University of California, Berkeley, USA, Springer ScienceþBusiness Media, ISSN 1558-9412, ISBN 978-0-387-71712-8 e-ISBN 978-0-387-71713-5 DOI 10.1007/978-0-387-71713-5LLC 2009 Michiel Steyaert, Arthur van Roermund, Low Voltage Low Power; Short Range Wireless Front-Ends; Power Management and DC- DC, ISBN 978-94-007-1925-5 e-ISBN 978-94-007-1926-2, DOI 10.1007/978-94-007-1926-2 Springer Dordrecht Heidelberg London New York, 2012 Patrick Girard, Power-Aware Testing and Test Strategies for Low Power Devices, ISBN 978-1-4419-0927-5 e-ISBN 978-1-4419- 0928-2 DOI 10.1007/978-1-4419-0928-2 Springer New York Dordrecht Heidelberg London, 2010 Xi Zhang, Vehicle Power Management Modeling, Control and Optimization, ISSN 1612-1287 e-ISSN 1860-4676 ISBN 978-0-85729-735-8 e-ISBN 978-0-85729-736-5 DOI 10.1007/978-0-85729-736-5, Springer London Dordrecht Heidelberg New York, 2011 Nihal Kularatna, DC Power Supplies Power Management and Surge Protection for Power Electronic Systems, CRC Press Taylor & Francis Group, 2012 Naser Khosro Pour, François Krummenacher and Maher Kayal, Electronics for Power and Energy Management, February 12th 2014, DOI: 10.5772/57281, www.intechopen.com/books/ict-energy-concepts-towards-zero-power-information-and-communication-technology/electronics-for-power-and-energy-management, 2014 Haruo Kobayashi, Takashi Nabeshima, Handbook Power Management Circuits, CRC Press Taylor & Francis Group, International Standard Book Number-13: 978-981-4613-16-3, 2016 STMicroelectronics, Power management guide, https://www.st.com/en/power-management.html 2018 Analog Devices, https://www.analog.com/en/products/power-management.html 2018 Mouser Electronics, https://eu.mouser.com/applications/power-management-technology/ 2018 Texas Instuments, http://www.ti.com/power-management/overview.html 2018.

9. Evaluation

Type of activity	**9.1** Evaluation criteria[13]	**9.2** Evaluation methods	**9.3** Share of the final grade
9.4 Course	Knowledge of fundamental notions and concepts. Involvement of students in discussions related to the specifics of the course.	Student participation in discussions related to the specifics of the discipline. Written assessment.	50%
9.5 Applied activities	**S:**		
	L: Individual work and teamwork to develop a research project based on experimental results. Clarity, coherence, conciseness of presentation, correct problem solving, correct interpretation of results, use of documentation sources, and application of acquired knowledge.	Discussions during the project development and activity report, timely completion of design/research stages, and final presentation of the report.	50%
	P:		
	Pr:		
	Tc-R[14]:		
9.6 Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified[15]			
• In order to promote the course and activities during the semester, students must be familiar with the main methods of reducing energy consumption in electronic systems. Completion of assignments during the semester.			

Date of completion 24.09.2025	**Course coordinator (signature)**	**Coordinator of applied activities (signature)**
Head of Department (signature)	**Date of approval in the Faculty Council** [16] 7.10.2025	**Dean (signature)**