POLYTECHNIC OF MEĐIMURJE IN ČAKOVEC

COURSE SYLLABUS

ACADEMIC YEAR:	2020/2021

1. GENERAL COURSE INFORMATION

1.1 Course name	**Digital electronic circuits**		
1.2 Study program/s	Undergraduate professional study of Computer Science		
1.3 Course status (O,E)	O	**1.6 Mode of instruction (number of hours)**	**Lectures** 30
1.4 Course code	DES		**Exercises** 45
1.5 Course abbreviation	5007		**Seminars**
1.6 Semester	II		**E-learning**
1.7 ECTS	6	**1.7 Place and time of instruction**	The premises of the Polytechnic of Međimurje in Čakovec, according to the schedule published on the website

2. TEACHING STAFF

2.1 Course leader/s-title	Jurica Trstenjak/ senior lecturer	contact	jtrstenjak@mev.hr
		contact	
2.2 Assistant/s- title		contact	
		contact	
2.3 Instruction held by- title	Jurica Trstenjak/ senior lecturer	contact	jtrstenjak@mev.hr

3. COURSE DESCRIPTION

3.1 Course goals	Student should acquire a functional overview of the basic components of modern digital electronic circuits, learn the basics of digital technique, logical algebra and the realization of more complex logical functions.
3.2 Prerequisites	It is necessary to have passed the subject Basics of Electrical Engineering and Electronics
3.3 Course outcomes	After successfully completing the course, students will be able to: O1 - Use different number systems and codes O2 - Apply minimization of logic functions and basic logic circuits O3 - Explain the operation of basic types of bistables O4 - explain the operation of basic combinational and arithmetic circuits O5 - use combinational circuits, registers and counters in the design of synchronous sequential circuits O6 - explain AD and DA conversion
3.4 Course content	Number systems. Codes. Logic circuits. Integrated circuits. Multivibrators. Minimization. Registers. Counters. Sequential circuits. Memories. A/D and D/A conversion.

3.5 Types of coursework	x	Lectures	x	Exercises		Blended e-learning	x	Individual activities		Laboratory
		Seminars and workshops	x	Distant learning		Field classes	x	Multimedia and network		Mentorship
		Other								

3.6 Language of instruction	Croatian/English					

3.7 Monitoring students' work (enter the number of ECTS credits for each activity so that the total number of ECTS credits is equal to the total ECTS value of the course, 1 ECTS = 30 hours)	2,5	Class attendance		Seminars		Essay
		Class activity		Project		Report/paper
	3	Exam (Midterm exams)	0,5	Practical task		Continuous knowledge check
		Written exam		Experimental work		
		Oral exam		Research		

3.8 Assessment and evaluation of students' work during classes and at the final exam

Activity specification	Percent %	Points
Assessment during instruction		
Attendance	5%	5
Class activity	5%	5
Oral part of midterms	15%	15
Midterm exam 1	20%	20
Midterm exam 2	20%	20
Midterm exam 3	20%	20
Practical task	15%	15
Exam assessment for the students who failed to fullfil all the obligatory requirements during the semester		
Written exam	*60%*	*60*
Oral exam	*15%*	*15*
Total:	**100%**	**100**

3.9 Assessment criteria – analysis per learning outcomes

Način polaganja ishoda								
	Attendance	Class activity	Midterm exam 1	Midterm exam 2	Midterm exam 3	Practical task	Oral part of midterms	Total
Outcome 1			10			2	2	14
Outcome 2			10			2	2	14
Outcome 3				10		3	3	16
Outcome 4				10		2	2	14
Outcome 5					10	3	3	16
Outcome 6					10	3	3	16
Outcome not-related	5	5						10
Total	**5**	**5**	**20**	**20**	**20**	**15**	**15**	**100**

Grading of outcomes (in order to pass the mid-term exam/exam the student must achieve at least 50% points for each learning outcome)

Points   Grade
89 – 100   excellent (5)
76 – 88   very good (4)
63 – 75   good (3)
50 – 62   pass (2)
 0 – 49   fail (1)

3.10 Specific features related with taking the course	In order for a student to pass the course, he / she must earn a minimum of 50% of the points available for that learning outcome for EACH learning outcome. If a student does not achieve a sufficient number of points in the 1st midterm exam (minimum 50% of the total number of points) or the 2nd midterm exam,

	she cannot take the next midterm exam. Once achieved points in intermediate exams for each learning outcome are no longer deleted unless the student decides to correct the result for each learning outcome, whereby the points won until then are deleted and newly achieved points for that learning outcome are entered. The final grade is obtained on the exam period and is the sum of points earned during classes. Students who did not take the colloquium take the written and oral part of the exam, where all learning outcomes are checked, and are required to submit all homework before taking the exam.
3.11 Students obligations	Full-time students are required to attend at least 70% of the total number of hours of lectures and exercises in order to exercise the right to take the exam. Part-time students are required to attend at least 30% of the total number of hours of lectures and exercises in order to exercise the right to take the exam. If the student has not fulfilled all the obligations set by the course, he is obliged to attend the lectures again and meet the conditions for taking the exam. Attendance can be offset by online tuition, organised webinars and added assignments given by teachers. One lesson lasts 45 minutes, and several hours form a teaching unit. Absence from one teaching unit is counted as one absence. Delays and apologies are recorded separately. In that case, if the student missed more than 50% of classes, and has a justifiable reason/apology, the request should be submitted to the Department Council, which then decides on the justification of student absences with the obligatory opinion of the course leader.
3.12 Written assignments	

3.13 Required reading	1.	Anil K. Maini: Digital Electronics: Principles, Devices and Applications 1st Edition, Wiley, West Sussex, 2007.
	2.	
3.14 Additional reading	1.	
	2.	

4 ADDITIONAL COURSE INFORMATION

4.1 Quality control	The quality of the program, teaching process, teaching skills and level of mastery of the material will be established by conducting a written evaluation based on questionnaires, and in other standardised ways and in accordance with the by-laws of the Polytechnic of Međimurje in Čakovec.
4.2 Contact the teacher	Students can contact the teacher during the office hours and during classes, while for short questions and explanations they can contact him/her any day during working hours by coming in person or by landline. It is also possible to ask questions by e-mail, which will be answered in 48 hours at the latest. It is desirable for students to come as often as possible for any possible questions during the teacher's office hours.
4.3 Information about the course	It is the obligation of each student to be regularly informed about the course. All notifications about the classes or possible postponement of classes will be posted on the bulletin board and on the website of the Polytechnic at least 24 hours in advance.
4.4 Course contribution to the study program	Apply the acquired learning skills, basic knowledge of the profession and problem solving necessary for continuing studies at a higher level. Analyze the basic elements of electrical engineering and digital circuits and identify the structure of the computer.

5. ANALYSIS OF COURSE TOPICS (the number of hours is equal to the number of lectures and exercises of the course)

		LECTURES		
Hours	**Topic and description**	**Method** • Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion) • Group learning • Case study • Field classes…	**Learning outcomes**	**Course outcome**
1. & 2.	Introduction. Number systems and codes	Discussion, lecture, PP presentation, case study	Use number systems and codes to display digital data	O1
3. & 4.	Boolean algebra	Discussion, lecture, PP presentation, case study	Apply axioms and basic theorems of Boolean algebra to logical functions and schemes	O1, O2
5. & 6.	Logic circuits	Discussion, lecture, PP presentation, case study	Realize logical functions using basic logic circuits	O2
7. & 8.	Complex logic circuits	Discussion, lecture, PP presentation, case study	Realize complex logic functions using basic logic circuits	O2
9. & 10.	1. midterm exam	On its own	Outcome check O1, O2	
11. & 12.	Multivibrators in digital electronics	Discussion, lecture, PP presentation, case study	distinguish the properties of multivibrators and their application	O3
13. & 14.	Registers	Discussion, lecture, PP presentation, case study	Be able to enumerate and explain the use of the register	O3, O4
15. & 16.	Counters	Discussion, lecture, PP presentation, case study	Know how to construct and explain meters	O3, O4
17. & 18.	2nd midterm exam	On its own	Outcome check O3, O4	
19. & 20.	Complex combination assemblies. Addition assemblies Multiplexer, demultiplexer	Discussion, lecture, PP presentation, case study	Construct combinational and sequential circuits	O5
21. & 22.	Encoders / Decoders	Discussion, lecture, PP presentation, case study	Explain the use of encoders and decoders	O5
23. & 24.	Memories	Discussion, lecture, PP presentation, case study	Enumerate and explain memories. Design ROM memory	O5
25. & 26.	D / A converter with weight resistors, A / D converter (Wilkinson converter)	Discussion, lecture, PP presentation, case study	Describe an analog-to-digital and a digital-to-analog converter	O6

Hours	Topic and description	Method	Learning outcomes	Course outcome
27. & 28.	3rd midterm exam (+ oral part of midterm)	On its own	Outcome check O5, O6	
29. & 30.	Repetition of exam materials	On its own	Outcome check O1- O6	O1-O6
EXERCISES/ SEMINARS				
Hours	**Topic and description**	**Method** • Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion) • Group learning • Case study	**Learning outcomes**	**Course outcome**
1., 2. & 3.	Number systems and codes	Self-solving	Use number system conversions and codes to display digital data	O1
4., 5. & 6.	Boolean algebra	Self-solving	Apply axioms and basic theorems of Boolean algebra to logical functions and schemes	O1, O2
7., 8. & 9.	Basic logic circuits	Independent solving with prog. Multisim	Realize logical functions using basic logic circuits, apply minimization of logical functions	O2
10., 11. & 12.	Universality of logic circuits	Independent solving with prog. Multisim	Realize logical functions using universal circuits (NI and NILI)	O2
13., 14. & 15.	Multivibrators in digital technology	Independent solving with prog. Multisim	Distinguish the properties of multivibrators and their application (7473 and 7474)	O3
16., 17. & 18.	Registers - serial and parallel data entry	Independent solving with prog. Multisim	Distinguish registry properties and their application	O3, O4
19., 20. & 21.	Counters	Independent solving with prog. Multisim	Distinguish the properties of meters and their application	O3, O4
22., 23. & 24.	Counters with 7493	Independent solving with prog. Multisim	Design counter using 7493	O3, O4
25., 26. & 27.	Shift register as a counter	Independent solving with prog. Multisim	Use counter 7493 as a shift register, apply 74175	O3, O4
28., 29. & 30.	Encoders / Decoders	Independent solving with prog. Multisim	Implement encoder and decoder with logic circuits and apply integrated decoder 7442	O5
31., 32. & 33.	7-segment display	Independent solving with prog. Multisim	Apply integrated decoder 4511	O5
34., 35. & 36.	Multiplexer, demultiplexer, addition assemblies	Independent solving with prog. Multisim	Realize multiplexer with 74151 and demultiplexer with 74139	O5
37., 38. & 39.	Programmable logic components	Independent solving with prog. Multisim	Design the ROM according to the default function	O5
40., 41. & 42.	D/A and A/D converter in	Independent solving with prog. Multisim	Apply integrated A/D and D/A converter	O6

	integrated technology			
43., 44 & 45.	Intermediate exam from exercises	On its own	Outcome check O1-O6	