

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	Elektrotehnika in elektronika
<b>Course title:</b>	Electrotechnics and Electronics

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Tehnologije in sistemi – prva stopnja	/	prvi	drugi
Technologies and Systems – 1st cycle	/	first	second

**Vrsta predmeta / Course type** obvezni/obligatory

**Univerzitetna koda predmeta / University course code:** TS 1 UN 6

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30		30			85	5

**Nosilec predmeta / Lecturer:** prof. dr. Marko Zavrtanik

<b>Jeziki / Languages:</b> slovenski/ slovenian	<b>Predavanja / Lectures:</b>	slovenski/Slovenian
	<b>Vaje / Tutorial:</b>	slovenski/Slovenian

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

- vpis v prvi letnik študija,
- pred izpitom mora študent(ka) uspešno opraviti praktične vaje.

**Prerequisites:**

- Enrollment in the first year of study,
- before the exam, the student must successfully complete practical tutorials.

**Vsebina:**

- *Teoretične osnove.* Elektrina in električni tok, električno in magnetno polje, prevodnik in dielektrik, enosmerna električna vezja, Theveninov teorem, Ohmov zakon, Kirchoffova zakona, kapacitivnost, induktivnost, prehodni pojavi v električnih vezjih, bilanca moči, izmenični signali, impedanca in reaktanca.
- *Analogna vezja.* Pasivni elementi, polprevodniki, dioda, bipolarni tranzistor,

**Content (Syllabus outline):**

- *Theoretical foundations.* Electricity and electric current, electric and magnetic field, conductor and dielectric, direct current, electric circuits, Thevenin's theorem, Ohm's law, Kirchoff's law, capacitance, inductance, transients in electric circuits, power balance, alternating signals, impedance and reactance.
- *Analog circuits.* Passive elements, semiconductors, diodes, bipolar transistors,

FET, linearizacija v okolici delovne točke, operacijski ojačevalnik, aktivni filtri in oscilatorji, regulatorji napetosti, šum.

- *Digitalna vezja.* Boolova algebra, logični nivoji, logična vrata, TTL in CMOS, aritmetična enota, kodiranje, kombinacijska vezja, pomnilniki, sekvenčna vezja, programabilna logična vezja.
- *Analogo/digitalna pretvorba.*

FET, linearisation around the operating point, operational amplifiers, active filters and oscillators, voltage regulators, noise.

- *Digital circuits.* Boolean algebra, logic levels, logic gates, TTL and CMOS, arithmetic unit, coding, combinational circuits, memories, sequential circuits, programmable logic circuits.
- *Analog/digital conversion.*

### Temeljni literatura in viri / Readings:

Horowitz, P., Hill, W. (1989) *The art of electronics*. Cambridge: Cambridge University Press.

Floyd, T. L. (2002) *Electronic devices*. New Jersey: Prentice Hall International.

Kleitz, W. (2002) *Digital Electronics, A Practical Approach*. New Jersey: Prentice Hall International.

Wedam, A. (1980). *Elektronika I*. Ljubljana: Založba FE in FRI.

### Cilji in kompetence:

*Cilji:* Spoznati teoretične osnove vezij, gradnike analognih in digitalnih elektronskih naprav. Pridobiti zanje za samostojno analizo in sintezo ter praktično izdelavo elektronskih vezij.

*Učna enota prispeva predvsem k razvoju naslednjih splošnih in specifičnih kompetenc:*

- sposobnost evidentiranja problema in njegove analize ter predvidevanja operativnih rešitev v tehnološkem smislu,
- sposobnost obvladovanja standardnih razvojnih metod, postopkov in procesov,
- sposobnost uporabe pridobljenega teoretičnega znanja v praksi,
- avtonomnost v strokovnem delu s področja tehnologij in sistemov,
- sposobnost razumevanja in uporabe sodobnih teorij s področja tehniških, tehnoloških in naravoslovnih ved,
- sposobnost matematičnega razumevanja tehničnih problemov in uporaba matematike pri reševanju le-teh,
- sposobnost reševanja konkretnih delovnih problemov na področju tehnologij in

### Objectives and competences:

*Objectives:* To learn the theoretical principles of circuits, building blocks of analog and digital electronic devices. To independently analyse and synthesize and to practically manufacture electronic circuits.

*The learning unit mainly contributes to the development of the following general and specific competences:*

- the ability to identify the problem and analyze it, as well as anticipate operational solutions in a technological sense,
- the ability to master standard development methods, procedures and processes,
- the ability to use acquired theoretical knowledge in practice,
- autonomy in professional work in the field of technologies and systems,
- the ability to understand and apply modern theories in the fields of technical, technological and natural sciences,
- the ability to understand technical problems mathematically and solve them with the help of mathematics,
- the ability to solve specific work problems in the field of technologies and systems using

sistemov z uporabo standardnih strokovnih metod in postopkov,

- razvoj strokovnih veščin in spretnosti na področju tehnologij in sistemov,
- izdelovanje, spremljanje in vodenje tehnične dokumentacije,
- sposobnost stalne uporabe informacijske in komunikacijske tehnologije na svojem strokovnem področju.

standard professional methods and procedures,

- development of professional skills and abilities in the field of technologies and systems,
- creation, monitoring and management of technical documentation,
- the ability to constantly use information and communication technology in one's professional field.

### **Predvideni študijski rezultati:**

Znanje in razumevanje:

*Študent/študentka:*

- pozna in razume osnovne zakone elektrotehnike,
- pozna gradnike analognih in digitalnih električnih vezij,
- razume delovanje polprevodniških elementov in vezij, zna analizirati nealinearne vezje z linearizacijo v okolici delovne točke, sposoben/-na je izvesti sintezo preprostih analognih vezij,
- razume funkcije in delovanje odločitvenih in pomnilniških preklonnih struktur. Zna analizirati delovanje sklopov in sestavov, sposoben/-na je zajemati probleme v formalnih jezikih in izvesti abstraktno in strukturno sintezo,
- pridobi osnovno znanje za praktično izdelavo analognih in digitalnih vezij,
- zna samostojno načrtovati električna vezja od formulacije zahtev preko strukturne sinteze do izdelave standardizirane dokumentacije za proizvodnjo posamičnih sklopov,
- sposoben/-na bo oceniti in izbrati najugodnejšo izvedbo glede na funkcionalno obsežnost, ekonomičnost in zanesljivost delovanja načrtovanega električnega vezja,
- pri predmetu bo razvil/-a naslednje spretnosti: načrtovanje analognih in digitalnih vezij, uporaba sodobne programske opreme pri načrtovanju in analizi delovanja elektronskih vezij, izdelava

### **Intended learning outcomes:**

Knowledge and understanding:

*Student:*

- knows and understands the basic laws of electrical engineering,
- knows the building blocks of analog and digital electrical circuits,
- understands the operation of semiconductor elements and circuits, is able to analyze non-linear circuits with linearization near the operating point, is able to synthesize simple analog circuits,
- understands the function and operation of decision and memory circuit structures. Knows how to analyze the operation of assemblies and compositions, is able to capture problems in formal languages and perform abstract and structural synthesis,
- acquires basic knowledge for practical production of analog and digital circuits,
- is able to design electrical circuits independently, from the formulation of requirements to structural synthesis and the preparation of standardized documentation for the production of individual assemblies,
- is able to evaluate and select the most favorable design in terms of functional scope, economy and reliability of the planned electrical circuit,
- within the framework of the course, students develop the following skills: design of analog and digital circuits, use of modern software for the design and analysis of electronic circuits, preparation of standardized

standardizirane dokumentacije za proizvodnjo elektronskih vezij.

documentation for the production of electronic circuits.

**Metode poučevanja in učenja:**

- *predavanja* z aktivno udeležbo študentov (razlaga, diskusija, vprašanja, reševanje nalog) ob pomoči sodobnih pedagoških pripomočkov,
- avditorne vaje za poglobljanje teoretičnih osnov,
- individualne in skupinske *konzultacije*,
- *laboratorijske vaje*, ki potekajo v ustrezno opremljenem laboratoriju ter računalniški učilnici, za samostojno praktično realizacijo vezij in izdelavo dokumentacije.

**Learning and teaching methods:**

- *lectures* with the active participation of students (explanation, discussion, questions, problem solving) with the help of modern pedagogical aids,
- *auditory tutorials* to deepen the theoretical foundations,
- individual and group *consultations*,
- laboratory tutorials, which take place in an appropriately equipped laboratory and computer classroom, for independent practical realization of circuits and production of documentation.

Delež (v %) /

Weight (in %) **Assessment:**

**Načini ocenjevanja:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt):

- končna ocena je povprečje rezultata pisnega in ustnega zagovora, pogoj za opravljanje pisnega izpita so pozitivno ocenjene praktične vaje.
- Ocenjevalna lestvica: ECTS.

Type (examination, oral, coursework, project):

- the final grade is the average of the result of the written and oral defense, the condition for passing the written exam is positively evaluated practical tutorials.

Grading scale: ECTS.