## Course description

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| Generic information |
| Head of Course | Rene Prenc, Ph.D. |
| Course | Fundamentals of Electrical Engineering 2 |
| Study Programme  | Marine Electronic Engineering and Information Technology |
| Level | undergraduate |
| Type of Course | mandatory |
| Year of Study | 1. |  |
| Estimated Student Workload and Methods of Instruction | ECTS coefficient of Student Workload | 7 |
| Number of Hours (L+E+S) | 45+30+0 |

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| 1. **GENERAL COURSE DESCRIPTION**
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| * 1. *Course Objectives*
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| Introduction to basic electrical quantities. Acquiring knowledge of basic phenomena and laws in the field of transients, alternating current circuits and three-phase systems. Ability to solve numerical problems in the field of electrical engineering. Performing experiments and qualitative analysis of established or measured quantities. |
| * 1. *Prerequisites for Course Registration*
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| None. |
| * 1. *Expected Learning Outcomes*
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| After passing the exam, students will be able to do the following:1. Explain the non-stationary (transient) state in direct current circuits.2. Explain the difference between direct and alternating current. Define the waveform of sinusoidal alternating voltage, then the period, frequency, momentary and maximum values, and the initial phase angle and phase shift. Recognize the importance of applying characteristic values ​​of maximum, effective and mean values ​​of currents and voltages in phasor and numerical analysis of alternating current circuits.3. Understand and adopt the physical principle of induction of sinusoidal electric voltage. Understand and recognize the importance of using complex numbers in numerical and phasor analyses of alternating current circuits.4. Describe the elements of alternating current circuits. Distinguish and physically describe the basic models of resistance and reactive (inductive and capacitive) elements in an alternating current circuit. Explain the basic laws in alternating current circuits (Ohm's law, I. and II. Kirchhoff's law, Thevenin's and Norton's theorem, the method of contour currents). Analyse and explain analytical calculations and phasor diagrams of alternating current circuits with serial and parallel connection of resistance and reactance elements. 5. Explain the concepts of active power associated with resistance and reactive power associated with the electric field of a capacitor and the magnetic field of a coil. Define the concept of power factor and power triangle for resistance-reactance composed consumers.6. Interpret the concept of resonance in alternating current circuits. Highlight the difference between serial and parallel resonance. Observe and recognize the application of self-induction and mutual induction in alternating current circuits.7. Describe a three-phase electrical system and the principle of generating three-phase voltage. Adopt the concepts of phase and line voltages and currents, and the connection of sources and loads into a star and a delta.8. Understand current-voltage conditions on symmetrical and asymmetrical three-phase consumers. Define the power of a three-phase system. Evaluate the role of the three-phase system in practice, and notice and point out the difference in the use of the three-phase system on land and ship power networks. |
| * 1. *Course Outline*
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| Non-stationary (transient) state in direct current circuits. Periodically changing electrical quantities. Characteristic values ​​of periodic quantities (effective and mean values). Elements of alternating current network. Application of complex calculus in the analysis of networks with sinusoidal currents and voltages. The concept and properties of impedance and admittance. Current and voltage resonance. Momentary, active, reactive and apparent power. Analysis of electric networks with linear elements (application of Kirchhoff's laws, contour current, Thevenin's and Norton's theorem, ...). Symmetrical and asymmetrical three-phase systems. Self-induction and mutual induction in alternating current networks. Physical principle of operation of three-phase generator and transformer. Application of three-phase systems in practice. |
| * 1. *Modes of Instruction*
 | [x] Lectures[ ]  Seminars and workshops [x]  Exercises [ ]  E-learning[ ]  Field work | [ ]  Practical work [ ]  Multimedia and Network [x]  Laboratory[ ]  Mentorship[ ]  Other \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| * 1. *Comments*
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| * 1. *Student Obligations*
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| 1st partial exam, 2nd partial exam, 3rd partial exam, final exam |
| * 1. *Assessment[[1]](#footnote-1) of Learning Outcomes*
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| Course attendance | 2,5 | Class participation | 0,5 | Seminar paper |     | Experiment |     |
| Written exam |     | Oral exam | 1 | Essay |     | Research |     |
| Project |     | Continuous Assessment | 3 | Presentation |     | Practical work |  |
| Portfolio |     |  |     |  |     |  |     |
| * 1. *Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam*
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| The procedure for evaluating the acquired learning outcomes takes place according to the Ordinance on Studies of the University of Rijeka and the Ordinance on Studying at the Faculty of Maritime Studies in Rijeka as follows:• through continuous testing of knowledge during classes, 70% of acquired learning outcomes are evaluated through attendance (10%), then the 1st partial exam - learning outcomes 1-4 (20%), the 2nd partial exam - learning outcomes 5-6 (20%), 3rd partial exam - learning outcomes 7-8 (20%);• in laboratory exercises the student must apply the acquired knowledge and demonstrate it through the measurement and interpretation of the values ​​of electrical quantities in single-phase and three-phase alternating current circuits.• At the final part of the exam, 30% of the acquired learning outcomes are evaluated (1-8), where the student must realize a minimum of 50% of points to pass the final exam.Examples of evaluating learning outcomes in relation to set learning outcomes are:1. Describe and interpret the laws of transients on the example of RC and RL circuit.2. On the example of sinusoidal alternating voltage and current, determine its period, frequency, maximum value, and the initial phase angle and phase shift. Calculate the maximum, effective and mean value of different current and voltage signals with special emphasis on constant DC and sinusoidal AC currents and voltages.3. On the example of sinusoidal alternating voltage and current, show the mappings of the mentioned signals from the time domain to the complex domain and vice versa. Show voltage and current phasors in a complex coordinate system.4. Analyse a simple alternating current circuit and describe its elements. Define current-voltage interdependence on each (active and passive) element of an alternating current circuit composed of resistance and reactive (inductive and capacitive) elements.5. Recognize and explain the complementarity of the application of numerical calculation and phasor analysis on the examples of alternating circuits with serial and parallel connection of resistance and reactive elements. Judge and point out when it is more favourable to apply numerical calculation and when to use the phasor analysis.6. On the examples of alternating current circuits with serial and parallel connection of resistance and reactance elements, recognize and explain the calculation of apparent, active and reactive power. Recognize and adopt on which elements it is spent, and on which it produces a certain form of power.7. Calculate the resonant frequency on examples of mixed circuits. On the example of transformers, prove the importance of adopting the concepts of self and mutual induction in practice.8. On the example of a three-phase consumer (motor), recognize and notice the difference between phase and line voltages and currents, and the connection of the consumer into a star and delta.9. Discuss and comment on the role of the three-phase system in land and ship electrical networks, and note the differences in their implementation.10. Demonstrate the acquired knowledge about AC circuits by recognizing and applying instruments for measuring electrical quantities on a specific example of single-phase and three-phase AC circuit. |
| * 1. *Main Reading*
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| * teaching materials for the course available on the e - learning system - Merlin (https://moodle.srce.hr)
* V. Pinter; Osnove elektrotehnike, Knjiga druga, Tehnička knjiga Zagreb, 1994.
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| * 1. *Recommended Reading*
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| * G. Đurović: Elektrotehnika II, Školska knjiga, Zagreb, 2004.
* B. Jajac: Teorijske osnove elektrotehnike, Svezak I-III, Graphis, Zagreb, 2001.-2007.
* B. Kuzmanović: Osnove elektrotehnike 2, Element, Zagreb, 2011.
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| * 1. *Number of Main Reading Examples*
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| *Title*  | *Number of examples* | *Number of students* |
| teaching materials for the course available on the e - learning system - Merlin (https://moodle.srce.hr) | - | 60 |
| V. Pinter; Osnove elektrotehnike, Knjiga druga, Tehnička knjiga Zagreb, 1994. | 5 | 60 |
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| * 1. *Quality Assurance*
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| The quality of studies is monitored in accordance with the ISO 9001 system and in accordance with European standards and guidelines for quality assurance, which is carried out at the Faculty of Maritime Studies in Rijeka. Once a year, the results of passability are analysed and appropriate measures are adopted. |

1. **NOTE**: Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities. [↑](#footnote-ref-1)