# Faculty of Electrical Engineering / ELECTRONICS, TELECOMMUNICATIONS AND COMPUTERS / BASICS OF ELECTRICAL ENGINEERING II

| **Course:** | BASICS OF ELECTRICAL ENGINEERING II | | | |
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| **Course ID** | **Course status** | **Semester** | **ECTS credits** | **Lessons** (Lessons+Exercises+Laboratory) |
| 99 | Mandatory | 2 | 7 | 3+2+1 |
| **Programs** | ELECTRONICS, TELECOMMUNICATIONS AND COMPUTERS | | | |
| **Prerequisites** | None | | | |
| **Aims** | To master the basic laws of the stationary magnetic field, the time-varying electric and magnetic fields; To introduce students to methods of analysis and to train them to solve linear AC electric circuits. | | | |
| **Learning outcomes** | Passing the exam in this subject means that the student is able to: 1. Define the concept of a stationary magnetic field and the basic quantities that describe it; 2. Calculate magnetic flux density by applying the Biot-Savart and Amperes law; 3. Define Faradays law of electromagnetic induction, interpret the direction of the induced emf and distinguish between its static and dynamic components; 4. Define the concepts of self and mutual inductance and calculate inductance in typical cases (solenoid, toroidal winding, two-wire line, coaxial line); 5. Explain the need to introduce the concept of rotating vector, phasor and complex calculus in the analysis of linear AC circuits; 6. Define the concept of complex impedance and admittance, complex power; 7. Interpret symbols and conventions in magnetically coupled circuits and define an ideal transformer; 8. Define the concept of voltage and current resonance, Q factor, amplitude and phase characteristics; 9. Define a balanced three-phase circuit and understand the wye and delta connections; 10. Solve the linear AC circuit using elementary transformations, methods and theorems, both using the phasor diagram in simple cases and using complex calculus. | | | |
| **Lecturer / Teaching assistant** | Prof. dr Gojko Joksimović, Aldin Kajević, MSc | | | |
| **Methodology** | "ex cathedra" teaching, blackboard exercises, laboratory exercises, consultations | | | |
| **Plan and program of work** | | | | |
| Preparing week | Preparation and registration of the semester | | | |
| I week lectures | Introduction, concept of a stationary magnetic field, permanent magnet, vector of magnetic flux density, Biot-Savart law | | | |
| I week exercises | Calculation of the magnetic flux density vector in high symmetry cases | | | |
| II week lectures | The theorem on the conservation of magnetic flux (Gauss law for magnetic field), Amperes law | | | |
| II week exercises | Magnetic flux calculation | | | |
| III week lectures | Ferromagnetic materials, generalized Amperes law, magnetic circuits | | | |
| III week exercises | Solving linear and non-linear magnetic circuits | | | |
| IV week lectures | Faradays law of electromagnetic induction, self and mutual induction coefficients | | | |
| IV week exercises | Calculation of induced electromotive force (emf) | | | |
| V week lectures | Magnetic field energy. Transients in first-order electric circuits. | | | |
| V week exercises | Calculation of the energy stored in the magnetic field. | | | |
| VI week lectures | Mid-term exam | | | |
| VI week exercises | Mid-term exam | | | |
| VII week lectures | Basic concepts of simple periodic quantities, rms value, the rotation vector and the phasor | | | |
| VII week exercises | Resistor, capacitor and inductor in AC circuits | | | |
| VIII week lectures | Elements and structure of AC circuits. General equations | | | |
| VIII week exercises | Circuit solution by means of phasor diagram - series and parallel RLC circuit, impedance, admittance | | | |
| IX week lectures | Power in AC circuits | | | |
| IX week exercises | Impedance triangle, power triangle, active, reactive and apparent power | | | |
| X week lectures | Introduction to complex analysis of AC circuits | | | |
| X week exercises | Solving an alternating current circuit using complex effective representatives | | | |
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| XI week lectures | Mesh current method and node potential method |
| XI week exercises | Application of two basic methods for solving AC circuits in the complex domain |
| XII week lectures | Basic principles and theorems of linear AC circuits |
| XII week exercises | Application of basic principles and theorems to linear AC circuits |
| XIII week lectures | Resonant circuits - voltage resonance and current resonance (antiresonance) |
| XIII week exercises | Analysis of resonant circuits |
| XIV week lectures | Magnetically coupled circuits. The ideal transformer |
| XIV week exercises | Analysis of magnetically coupled circuits. |
| XV week lectures | Symmetrical three-phase circuits - analysis of wye and delta connection |
| XV week exercises | Solving simple symmetrical three-phase electrical circuits |
| **Student workload** | 9 hours and 20 minutes per week (3 hours of lectures + 2 hours of computing exercises + 1 hour of laboratory exercises + 3 hours and 20 minutes of individual work) |

| **Per week** | **Per semester** |
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| **7 credits x 40/30=9 hours and 20 minuts**<br>3 sat(a) theoretical classes<br>1 sat(a) practical classes<br>2 excercises<br>**3 hour(s) i 20 minuts**<br>of independent work, including consultations | Classes and final exam:<br>**9 hour(s) i 20 minuts x 16 =149 hour(s) i 20 minuts**<br>Necessary preparation before the beginning of the semester (administration, registration, certification):<br>**9 hour(s) i 20 minuts x 2 =18 hour(s) i 40 minuts**<br>Total workload for the subject:<br>**7 x 30=210 hour(s)**<br>Additional work for exam preparation in the preparing exam period, including taking the remedial exam from 0 to 30 hours (remaining time from the first two items to the total load for the item)<br>**42 hour(s) i 0 minuts**<br>Workload structure: **149 hour(s) i 20 minuts (cources), 18 hour(s) i 40 minuts (preparation), 42 hour(s) i 0 minuts (additional work)** |
| **Student obligations** | Attending lectures and calculus (blackboard) exercises, laboratory exercises |
| **Consultations** | As a rule, on the day when classes and calculus exercises are organised - after calculus exercises. In any other term - compulsory announcement by e-mail. |
| **Literature** | Gojko Joksimović, Fundamentals of Electrical Engineering II, Edition ETF Textbooks; Gojko Joksimović, Calculation exercises from OEII, textbook |
| **Examination methods** | Mid-term exam worth 40 out of a total of 100 points that can be achieved during the semester. The final exam is worth 60 marks. Both types of examinations are written examinations. However, the professor reserves the right to invite the student to an oral examination if he considers that the written examination is questionable. |
| **Special remarks** | Laboratory exercises are compulsory. During the semester, students are required to complete the laboratory exercises. Completed labs are a prerequisite for taking the final exam. |
| **Comment** | The number of hours per week is 3+2+1 (3 hours of lectures, 2 hours of blackboard exercises and 1 hour of laboratory exercises). The course is worth 7 ECTS credits. |

| **Grade:** | F | E | D | C | B | A |
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| **Number of points** | less than 50 points | greater than or equal to 50 points and less than 60 points | greater than or equal to 60 points and less than 70 points | greater than or equal to 70 points and less than 80 points | greater than or equal to 80 points and less than 90 points | greater than or equal to 90 points |