# Specification for the book of courses

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| **Study program** | Electrical Engineering and Computer Science | | |
| **Module** | Electrical Power Engineering | | |
| **Type and level of studies** | Undergraduate Academic Studies | | |
| **The name of the course** | Electrical Traction and Vehicle | | |
| **Lecturer (for lectures)** | Petronijević P. Milutin | | |
| **Lecturer/associate (for exercises)** | Filipović R. Filip | | |
| **Lecturer/associate (for OFE)** | Filipović R. Filip | | |
| **Number of ECTS** | 5 | **Course status (obligatory/elective)** | Elective |
| **Prerequisites** | None | | |
| **Course objectives** | Basic knowledge about tractive effort and electric vehicle kinematics and dynamics. Learning about vehicle power converters and motors. Understanding of operating modes and traction control methods. | | |
| **Course outcomes** | Acquisition of knowledge regarding electric traction running resistance, tractive effort, adhesion, power and energy consumption; Electric vehicle drives calculation; Basic knowledge about selection of pover converters and drives for electric vehicles. | | |
| **Course outline** | | | |
| **Theoretical teaching** | General principles of electric traction and traction systems. Tractive and braking effort. Adhesion. Power requirements and energy consumption. Traction vehicles: electric drives, transformers and converters, control and mechanical transmission. Traction motors: DC motors, induction motors, PM motors. Power supply systems - AC and DC supplies. Dynamic and regenerative braking. Electric vehicle: configuration and performance. Control of Electric Vehicles. Hybrid vehicle: series and parallel types, performances. Electric vehicles. Power consumption optimization. | | |
| **Practical teaching (exercises, OFE, study and research** | Numerical exercises: calculation of traction resistance. Adhesion. Dynamic equation of vehicle motion. Locomotive with diode and thyristor based converters. AC motor electric vehicles. Basic calculation and selection of vehicle power converters. Dynamic and regenerative braking. Laboratory exercises: Vehicle motor simulation. Control of vehicle tractive efforts. Vehicle energy consupmtion optimization. | | |
| **Textbooks/references** | | | |
| 1 | B. Radojković “Electric traction”, Scientific book, Belgrade, 1990 (in Serbian) | | |
| 2 | J. G. Hayes, G. A. Goodarzi, Electric powertrain : energy systems, power electronics and drives for hybrid, electric and fuel cell vehicles, Wiley, 2018. | | |
| 3 | S. N. Vukosavić..., “Electric traction - workbook”, ETF Belgrade, 1997 (in Serbian) | | |
| 4 | M.Ehsani, Y. Gao, ,”Modern Electric, Hybrid Electric and Fuel Cell Vehicles”, Crc Press 2005. | | |
| 5 | Ali Emadi, Advanced Electric Drive Vehicles, McMaster University, Hamilton, Ontario, Canada, 2015 | | |

| **Number of classes of active education per week during semester/trimester/year** | | | | |
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| **Lectures** | **Exercises** | **OFE** | **Study and research work** | **Other classes** |
| 2 | 2 | 1 | 0 | 0 |
| **Teaching methods** | Lectures with application of slides, animations and simulations. Auditory exercises with numerical examples refers students to solve problems in connection with lectures and from engineering practice. Laboratory exercises - MATLAB simulation and experiments with test bench tor electric traction drives. Study visit to specialized local companies. Student seminar work. | | | |

| **Grade (maximum number of points 100)** | | | |
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| **Pre-exam duties** | **Points** | **Final exam** | **Points** |
| **Activity during lectures** | | **Written exam** | 20 |
| **Exercises** | 20 | **Oral exam** | 20 |
| **Colloquia** | 20 | | |
| **Projects** | 20 | | |