



## RTU Course "Theory of Electronic Converters of Electrical Energy"

11103 Industriālās elektronikas un elektrotehnol.katedra

### General data

|   |   |
|---|---|
| Code  | EEP584  |
| Course title  | Theory of Electronic Converters of Electrical Energy  |
| Course status in the programme  | Compulsory/Courses of Limited Choice  |
| Course level  | Post-graduate Studies   |
| Course type   | Academic  |
| Field of study  | Power and Electrical Engineering  |
| Responsible instructor  | Ivars Raņķis  |
| Volume of the course: parts and credits points                        | 1 part, 4.0 Credit Points, 6.0 ECTS credits   |
| Language of instruction   | LV, EN, RU  |
| Possibility of distance learning                                      | Not planned   |
| Abstract  | General theory of energy conversion. Rectifiers and line-frequency controlled inverters. Autonomous inverters. Current-source, voltage-source and resonance mode inverters. Modulation methods. BUCK and BOOST converters. Frequency converters with high-frequency links. Matrix type converters. Cycloconverters. |
| Goals and objectives of the course in terms of competences and skills | Provide enhanced learning of operation principles of power converters, processes at its operation as also methods of its calculation and modeling   |
| Structure and tasks of independent studies                            | 10 home tasks on calculation of different converters, 5 laboratory works on modeling of converters in Virtuallab computer space   |
| Recommended literature  | I.Raņķis Energoelektronika. Rīga:RTU, 2002, 142 lpp<br>N.Mohan, T.Undeland, W.Robbins Power Electronics. NY: John Wiley &sons, 2002, 667 p<br>I.Raņķis, I.Buņina Energoelektronika. - Rīga:RTU, 2007, 187 lpp.  |
| Course prerequisites  | Power electronics   |

### Course outline

| Theme  | Hours |
|--|-------|
| Evaluation and measurement of electrical signals in power converters                               | 2     |
| Parameters of reactive elements in periodical processes of power converters                        | 2     |
| AC-DC uncontrolled and controlled convertation, influence on AC network                            | 4     |
| Differential equations of processes in power converters and its solutions                          | 4     |
| Reversibility principle of AC-DC controlled rectifiers and its realization, limitations            | 4     |
| Power factor, harmonic distortions of AC network current   | 4     |
| Control systems for AC-DC rectifiers, automated its regulation, computer modeling                  | 4     |
| Cycloconverters, AC regulators, its application, influence on network and load, optimization       | 4     |
| DC pulse regulators, schemes, differential equations, parameters of supply source and load         | 6     |
| Filters, its optimization, calculation of reactor's electro-magnetic parameters                    | 6     |
| Reversible pulse regulator, control, application, sinus modulation, parameters, modeling           | 6     |
| Single-phase and 3ph voltage source inverters, sinus modulation of load current, control, modeling | 4     |
| Current source inverters CSI, its parameters, schemes, control, connections, modeling              | 4     |
| Comparison of the VSI and CSI  | 2     |
| An active rectifiers, applications, functions, control, parameters, modeling                       | 4     |
| Multi-level and matrix converters, realization,control,influence on load and network               | 4     |

### Learning outcomes and assessment

| Learning outcomes   | Assessment methods  |
|---|---|
| To be able manage mathematical description of converters operation and calculation of processes         | Defended calculation works  |
| To be able manage calculations of operation parameters of different converters in the stationary regime | Defended calculation works  |
| To be able realize computer models of converters and provide computer modeling                          | Defended calculation works with presentaion of computer modeling results for different converters |

### Study subject structure

| Part | CP  | ECTS | Hours per Week |           |      | Tests |      |      |
|------|-----|------|----------------|-----------|------|-------|------|------|
|      |     |      | Lectures       | Practical | Lab. | Test  | Exam | Work |
| 1.   | 4.0 | 6.0  | 2.0            | 0.0       | 2.0  |       | *    |      |