



## RTU Course "Thermotechnical Measurements and Fundamentals of Automation"

15016 Siltumenerģētisko sistēmu katedra

### General data

Code	MSE323
Course title	Thermotechnical Measurements and Fundamentals of Automation
Course status in the programme	Compulsory/Courses of Limited Choice
Course level	Undergraduate Studies
Course type	Academic
Field of study	Heat Engineering, Heat, Gas and Water Technology
Responsible instructor	Turlajs Daniels
Volume of the course: parts and credits points	1 part, 2.0 Credit Points, 3.0 ECTS credits
Language of instruction	LV, EN, RU
Possibility of distance learning	Not planned
Maximum auditorium capacity	50
Maximum number of students per semester	50
Abstract	Study subject „Thermotechnical Measurements and Fundamentals of Automation" reviews measurement methods and technical equipment for heat and power engineering processes. Main topics: Measurement and metrology. Temperature, pressure, level, substance flow dynamics, humidity, concentration measurements, fuel gas analysis – methods and technical facilities. Automated control systems (ACS). Static and dynamic properties of objects to be automated. Principles and quality of automated control. Boilers and boiler house automation. Automation of heating and hot water supply, air conditioning and ventilation, drying, evaporative systems. Refrigeration equipment automation. Technical means of ACS. Adjustment and regulation algorithms. Signal transducers, actuators.
Goals and objectives of the course in terms of competences and skills	To acquire the theoretical foundations of thermal measurements and ACS of thermal engineering processes. To learn the measurement methodology of the thermodynamic and physical parameters and acquire skills of replenishing a specific object with the necessary technical facilities and instrumentation. Acquire the needed skills for design and operation of technological measurements, alarm and automated control systems.
Structure and tasks of independent studies	Regular lecture and tutorial material and special technical literature studies, calculus and designing work. Working with the product catalogues of manufacturers of measuring instruments and technical means of ACS.
Recommended literature	1.Figliola R.S., Beasley D.E. Theory and Design for Mechanical Measurements, 4-th Edition, John Wiley&Sons Press, 2005, 560 p. 2.Nise N.S. Control Systems Engineering. John Wiley&Sons Press, 2003, 1008 p. 3.Valpēteris M. Siltumtehnikiskie mērījumi. RTU FMF SES katedra, ESF projekts, 2007, 35 lpp. 4. Dzelzītis E. Siltuma, gāzes un ūdens inženiersistēmu automatizācijas pamati. R., 2005. 5.Tehniskie mērījumi aparātbūvē un mašīnbūvē. E. Širons Rīga „Zvaigzne”, 1982. . 6.Иванова Г.М., Кузнецов Н.Д., Чистяков В.С. Теплотехнические измерения и приборы. М., МЭИ, 2005, 458 с. 7. Ротач В.Я. Теория автоматического управления теплоэнергетическими процессами. - М. : Энергоатомиздат, 1985. - 350 с. 8.LVS ISO 5725-1:2006. Mērīšanas metožu un rezultātu pareizība (patiesums un precizitāte). 9.LVS EN 14597:2006. Siltumražošanas sistēmu temperatūras vadības ierīces un temperatūras ierobežotāji. Temperatūras mērīšanas instrumenti. Automātiskās kontrolierīces
Course prerequisites	Physics, Technical Thermodynamics, Heat Transfer.

### Course outline

Theme	Hours
Vispārējās ziņas par mērījumiem, mērīšanas līdzekļiem un metodēm. Metroloģija un verifikācija.	3
Siltumtehnikiskie mērījumi, to rezultātu apstrāde un kļūdas.	2
Mērīšanas informācijas pārveidošanas un pārvades sistēmas.	3
Temperatūras mērīšana. Metodoloģija un tehniskie līdzekļi.	6
Spiediena un retinājuma mērīšana. Metodoloģija un tehniskie līdzekļi.	6
Šķidruma, gāzes un tvaika plūsmu ātruma, daudzuma un patēriņa mērījumi.	3
Šķidrumu un cietu beramu vielu līmeņa mērījumi.	2
Šķidrumu un gāzu fizikāli-ķīmisko īpašību mērīšana. Koncentrācijas mērīšana (izplūdes un dūmgāzu analīze).	2
Siltumtehnikisko mērījumu tehniskais un metroloģiskais nodrošinājums.	2
Siltumtehnikisko mērījumu sistēmu un shēmu projektēšana.	2
Automātiskās regulēšanas teorijas pamati. Pārejas procesi automātiskās regulēšanas sistēmās.	2
Regulēšanas likumi, regulatoru tipi (P, PI, PID).	2
Regulēšanas procesu dinamika. Regulēšanas procesu kvalitāte.	3
Automatizācijas tehniskie līdzekļi. Siltumenerģētisko procesu kontroles, vadības, automatizācijas un signalizācijas shēm	2

**Learning outcomes and assessment**

Learning outcomes	Assessment methods
Ability to explain, analyze and select working parameters for measuring methods, measuring devices and automated control and alarm system elements and equipment parameters used in thermal engineering applications.	Assessment methods: Calculation and practical work. Tutorials and discussions. Tests. Exam. Criteria: Ability to explain and justify operating principles, structure and meaning of devices used in instrumentation and control systems of the processes and equipment of thermal engineering.
Ability to choose the necessary instrumentation and equipment for ACS of the given technological process.	Assessment methods: Calculation and practical work. Tutorials and discussions. Tests. Exam. Criteria: The ability to explain processes of thermal plants, to evaluate the measuring range of parameters, to select the types of technical means of ACS and justify their choice.
Ability to work in practice with standard equipment of temperature, pressure, fuel gas composition and other parameters.	Assessment methods: Calculation and design work. Discussions. Writing and defending Project report and drawing schemes. Criteria: knowledge of the operation principles of measuring equipment in thermal engineering. Ability to apply theoretical knowledge in practical work.

**Study subject structure**

Part	CP	ECTS	Hours per Week			Tests		
			Lectures	Practical	Lab.	Test	Exam	Work
1.	2.0	3.0	2.0	1.0	0.0		*	