Country	Institution	Module	ECTS
BULGARIA	Vasil Levski National Military University	**Electrical Measurements**	**4.0**

Service	Minimum Qualification for Lecturers
ICT	• English: Common European Framework of Reference for Languages (CEFR) Level B2 or NATO STANAG 6001 Level 2. • Physics. • Electrical Engineering.
Languages **English, Bulgarian**	

Prerequisites for international participants:	Goal of the Module:
• English: Common European Framework of Reference for Languages (CEFR) Level B1 or NATO STANAG Level 2. • 3rd year of national (military) higher education. • Knowledge of Physics and Electrical Engineering.	• Introduction to the basic principles and laws of physics used in measuring instruments (MIs). • Description of various MIs. • Development of skills for practical work with MIs.

Learning outcomes		
	Knowledge	• Classification and signatures of MIs. • Construction and operation principles of various MIs.
	Skills	• Abilities to operate and maintain various MIs.
	Competences	• Design and construction of MIs. • Estimation and calculation of parameters of MIs.

Verification of learning outcomes

- **Observation**: Throughout the course students are to accomplish different practical tasks individually or in teams.. During the tasks students are to be evaluated for competences.
- **Test**: At the end of the course, the students have to accomplish a test.

Module Details		
Study topics	**class hours**	**Details**
Chapter I "Introduction to electromechanical devices"		
Fundamentals of electrical measurements	2	• Classification and properties of measurements and units – 1 hour • Principles and laws of physics used in construction and operation of MIs – 1 hour
Chapter II "Electro-mechanical MIs"		

Analog MIs	6	• Electro-magnetic moving coil instruments– 2 hours • Electro-static MIs (Moving iron instruments) – 2 hours • Permanent magnet moving coil instruments – 2 hours
Chapter III "Digital MIs"		
Digital MIs	6	• Digital frequency counter – 2 hours • Digital voltmeter – 2 hours • Digital wattmeter – 2 hours
Chapter IV "Oscilloscope"		
Oscilloscope	2	• Construction of Oscilloscope – 1 hour • Operational modes – 1 hour
Chapter V "Measuring techniques"		
Measuring techniques	4	• Measuring various electric units – 4 hours
Chapter VI "Practical work and assessment"		
Practical work	22	• Study of various MIs in laboratory • Completion of specific tasks
Assessment	3	Test – 3 hours
Additional hours to increase the learning outcomes		
Self-Study	30	• Enhancing knowledge by studying various MIs. • Reflection of the topics issued.
Total	45	**Lectures: 20 Practical work and assessment: 25**

This study course description is created and revised at "Communication network and systems" Department and accepted at Faculty council.

Developed by:

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REFERENCES:

1. Northrop R.B.: Introduction to Instrumentation and Measurements, CRC 2005, 0-8493-3773-9
2. V. Haasz, M. Sedláček: Electrical Measurements. University Textbook, Publishing House of CTU in Prague, Prague, 2006
3. Г. Георгиев, "Електрически измервания"
4. Г. Георгиев, „Ръководство за лабораторни упражнения"