

Quality Engineering - Case study UL-FE

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Objective

Quality engineering expertise is today of utmost importance. There are very short product and services development schedules, rapid changes of products and great pressure on quality. In the history there were numerous people struggling for one product, nowadays there are numerous products available for one customer. The quality is of utmost importance. Cost benefit and added value are strongly related to quality deployment. The quality methods are powerful tool that can be used to de-risk the possibility of low quality of final product. Curriculum related to quality subject are not very common at technical universities.

This paper presents quality engineering study as a case study at University of Ljubljana (UL), Faculty of Electrical Engineering (FE). The development of the study from 1997 to 2015 with benefits and problems. Constant development of the program is needed and implementation of new knowledge from the quality conferences, forums, etc. is important solution for giving students the best and the latest information. In spite certain problems, the Bologna Process still aims to facilitate mobility by providing common tools (such as a European Credit Transfer and accumulation System - ECTS and the Diploma Supplement) to ensure that periods of study abroad are recognised. Beside that the European Community Action Scheme for the Mobility of University Students (ERASMUS) enables to spread the idea of quality in broader manner. This paper presents the UL-FE experience. There is a challenge to raise the popularity of the quality thematic between engineering students. Paper presents also practical examples of implementation of quality tools for improving the quality engineering study as well as for industry support. Practical example projects, where also student are involved are very good practical experience for students to improve the theoretical knowledge. In case of quality engineering study development and support this paper raises question who is the customer: student, industry, university, etc. Internally at the institutes/faculties there is also a competition among traditional study programs and new also quality oriented studies. The proposed paper presents one specific point of view, while there are certainly numerous other experiences.

A graduate study program Quality Engineering has been prepared at the University of Ljubljana, Faculty of Electrical engineering, Slovenia, in close co-operation with three other European universities in order to provide formal educational program for the measurement/metrology related activities and quality with strong emphasis in metrology and quality.

The curriculum which was developed, reflecting most of the needs in modern societies regarding the metrological problems in production and services quality and society itself.

Special attention was given to particular course syllabuses in order to concentrate on key issues in measurement science and let students work creatively and do as much as possible practical and experimental work.

In the study course, industrial placement for the students was included in order to strengthen ties with industry and Universities, as well to prepare students for real life working environment. A lot of students stay employed in those companies.

The entire study program, with emphasis in metrology, measurement techniques and instrumentation science and quality engineering was initiated as a support to quality production, quality services and other quality aspects, that has been in the past taught mainly as a part of various other lessons, not as a discipline or a study program by itself. It was typically more management than technically oriented.

The objective of the undergraduate study program, that has started it's first year in Autumn 1998, is to provide this absolutely crucial knowledge in a form of a compact study program essential for new emerging economies entering global markets. In Europe, there is an additional requirement for wide knowledge in metrology, since the implementation of European Directives actually starts with metrology infrastructure, which is prerequisite for testing, certification, conformity assessment and finally directives implementation. The Bologna process reorganise a bit the program. The core contents on metrology and quality part is upgraded to up to date information.

1st Cycle Higher Professional Study Programme in Applied Electrical Engineering

Length of the study programme: **3 years**.

Number of ECTS credits of the study programme: **180**

Professional title conferred: **degree in electrical engineering (dipl. ing. el.)**

Study programme options:

- Control Engineering,
- Electronics,
- Power Engineering Technology and System Automation,
- Telecommunications,
- **Quality Engineering.**

The aim of the Quality Engineering program is to get acquainted with different fields of Electrical Engineering and concrete knowledge on establishment and quality assurance of production and services. In scope of this program students gather separate knowledge for total quality assurance. In this scope is meant quality system assessment and certification and getting acquainted with tools and methods for achieving best results. Student gets knowledge on solving problems using quality tools. In addition student gets acquainted with reliability, economy, legislation and safety. Students get knowledge on practical examples of quality systems.

Intended learning outcomes in terms of Quality:

basic concept of technical infrastructure, standardization, accreditation, European quality legislation, drafting a standard, knowledge on types of standards, quality assurance, knowledge on assessment and certification process, knowledge on directives of new and global approach, CE marking and modular approach in it, importance and concept of technical documentation of a product, knowledge on total quality management, quality management systems, quality tools for quality assurance, QFD and FMEA methods for quality management, connection of quality and law, safety and environment, concrete technical knowledge on testing, knowledge on laboratory work for quality assurance and safety, preparation of optimal experiment, implementation of quality systems and preparation of quality management according to a standard.

Core

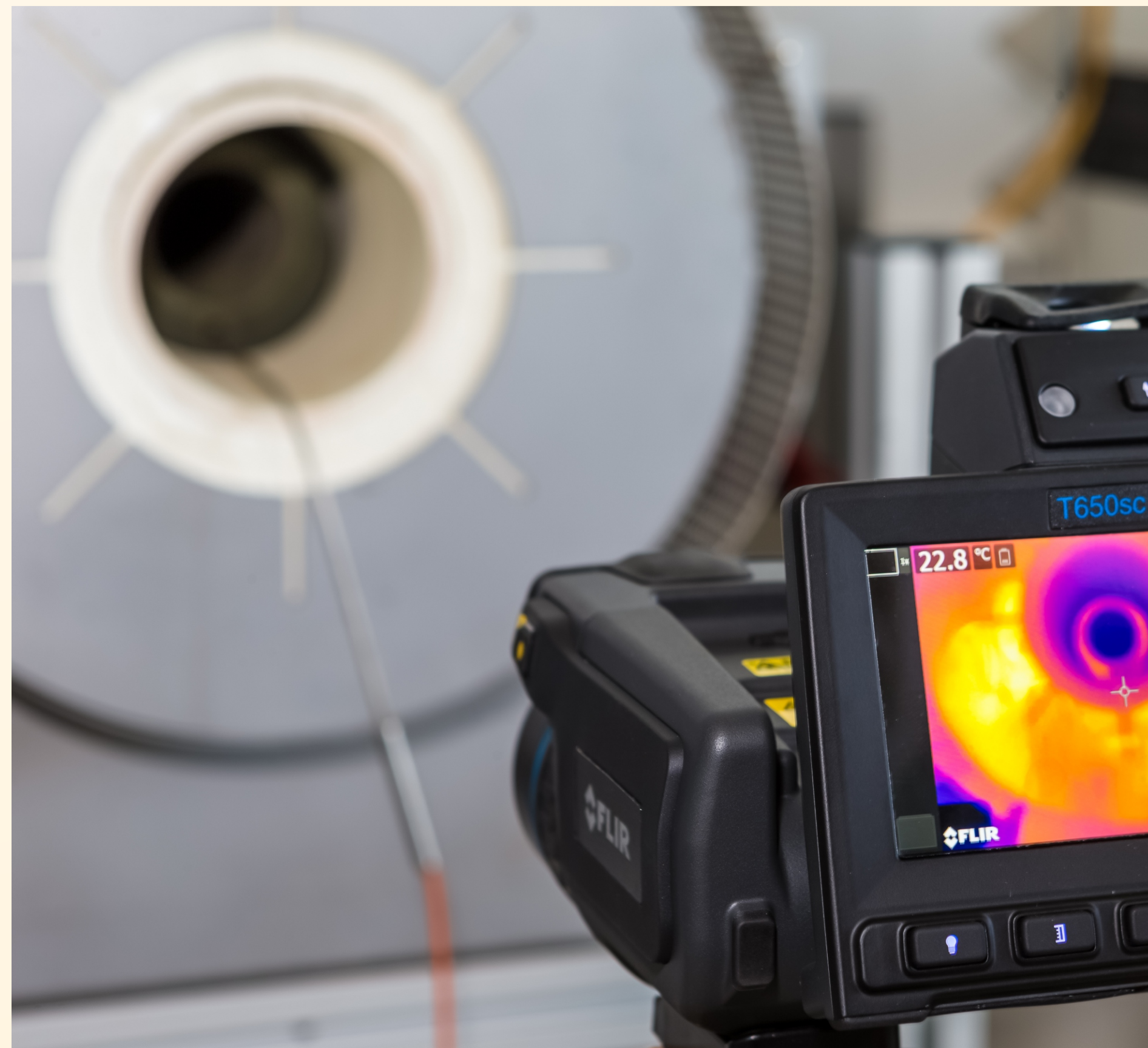


Figure 1: Quality engineering consists of various fields (see the program)

QUALITY ENGINEERING

1st Cycle Higher Professional Study Programme in Applied Electrical Engineering

1. Year	Contact hours			ECTS
	Lect.	Avdit.	Lab.	
1. Semester				
Mathematics I	60	60	0	9
Mechanics and heat (Physic I)	45	45	0	7
Fundamentals of Electrical Engineering I	60	45	15	9
Programming I	30	15	15	5
Sum 1. semester				30
2. Semester				
Mathematics II	45	45	0	7
Atomics and optics (Physic II)	45	30	0	6
Fundamentals of Electrical Engineering II	60	15	30	7
Programming II	30	15	15	5
Technical Quality	30	0	30	5
Sum 2. semester				30
Sum 1. year				60
2. Year				
	Lect.	Avdit.	Lab.	ECTS
3. Semester				
Measurement methods and instrumentation	45	0	45	6
Electronics with Digital Techniques	45	0	30	6
Software Engineering	45	0	30	6
Microcontroller systems	45	0	30	6
Modelling and signal processing	45	0	30	6
Sum 3. semester				30
4. Semester				
Sensors and Measurement Transducers	30	0	30	5
Metrology	45	0	30	5
Testing and Energy Efficiency	45	0	30	5
Statistical Process Control	30	0	30	5
Regulation and control technology	30	0	30	5
<u>Elective study programme subjects:</u>				
Robotics	30	0	30	5
Fundamentals of Microprocessor Electronics	30	0	30	5
Electrical Installations and Lighting	30	0	30	5
Optical communications	30	0	30	5
English	30	30	0	5
Physical education	10	65	0	5
Sum 4. semester				30
Sum 2. year				60
3. Year				
	Lect.	Avdit.	Lab.	ECTS
5. semester				
Systems Quality	45	0	45	7
Robotics and Measurements	45	0	45	6
Reliability and maintenance of components and systems	45	0	45	7
<u>Study programme modules (modules are elective):</u>				
Module A: Process measurement systems	30	0	30	5
Module A: Control of Quality and Reliability	30	0	30	5
Module B: Integrated Circuits	30	0	30	5
Module B: Digital Electronic Systems Design	30	0	30	5
Module C: Electromagnetic Devices Design	30	0	30	5
Module C: Elektroenergetics	30	0	30	5
Module D: Safe Communications	30	0	30	5
Module D: Satellite Communications and Navigations	30	0	30	5
Module E: Software Quality	30	0	30	5
Module E: Innovation Process and Patenting	30	0	30	5
Module F: Applied Electromagnetics	30	0	30	5
Module F: Practical Mathematics	30	0	30	5
Sum 5. semester				30
6. semester				
Practical Training			500	20
Diploma Work			250	10
Sum 6. semester				30
Sum 3. year				60

2nd cycle postgraduate study programme in Electrical Engineering

European technical legislation and infrastructure
Technical Quality

3rd cycle Doctoral study programme in Electrical Engineering

Metrology and Quality Systems