# STUDY MODULE DESCRIPTION FORM

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|---|---|---|
| Name of the module/subject<br>**Quality Management and Experimental Software Eng.** | | Code<br>**1010512321010517900** |
| Field of study<br>**Computing** | Profile of study (general academic, practical)<br>**general academic** | Year /Semester<br>**1 / 2** |
| Elective path/specialty<br>**Software Engineering** | Subject offered in:<br>**English** | Course (compulsory, elective)<br>**obligatory** |
| Cycle of study:<br>**Second-cycle studies** | Form of study (full-time,part-time)<br>**full-time** | |
| No. of hours<br>Lecture: **-** Classes: **30** Laboratory: **-** Project/seminars: **30** | | No. of credits<br>**4** |
| Status of the course in the study program (Basic, major, other)<br>**major** | (university-wide, from another field)<br>**from field** | |
| Education areas and fields of science and art<br>**technical sciences**<br>**Technical sciences** | | ECTS distribution (number and %)<br>**4 100%**<br>**4 100%** |

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## Prerequisites in terms of knowledge, skills and social competencies:

| | | |
|---|---|---|
| 1 | **Knowledge** | Student shall have a general knowledge regarding software engineering and math. |
| 2 | **Skills** | Student shall have necessary skills to formulate and test simple statistical hypotheses, skills necessary to prepare a short scientific report, and skills necessary to acquire information from given sources of information. |
| 3 | **Social competencies** | Student shall understand necessity of continuous development of skills and show attitudes as honesty, responsibility, perseverance, curiosity, creativity, manners, and respect for other people. |

## Assumptions and objectives of the course:

- Provide knowledge regarding experimental software engineering, especially related to empirical research methods and their theoretical foundations,
- Provide knowledge regarding quality management, especially related to quality management systems, assessment of processes maturity and their continuous improvement,
- Develop students? skills in solving problems related to evaluation of methods, tools, and phenomena in software engineering using empirical methods,
- Develop students? skills in solving problems related to evaluation and improvement of software development processes within an organization.

## Study outcomes and reference to the educational results for a field of study

### Knowledge:

1. has advanced and deep knowledge concerning applying experimental methods in software engineering - [K2st_W1]
2. has advanced and deep knowledge concerning software measurement (GQM+Strategies, measurement scales, types of measures) - [K2st_W1]
3. has organized and well-formed theoretical general knowledge regarding lean management and its application to software development - [K2st_W2]
4. has organized and well-formed theoretical, general knowledge regarding maturity of software development processes (CMMI) - [K2st_W2]
5. has advanced and detailed knowledge regarding reviews and inspections - [K2st_W3]
6. has general knowledge regarding quality assurance at the organization level (e.g. ISO 9001, TQM, ITIL) - [K2st_W8]

### Skills:

1. is able to acquire knowledge from the literature, also by performing a systematic literature review - [K2st_U1]
2. is able to plan and conduct experiments and interpret and discuss their results - [K2st_U3]
3. is able to select an appropriate empirical research method to formulate research problem / research question (e.g., experiment, case study, survey, meta-analysis) - [K2st_U4]
4. is able to integrate knowledge from computer science and statistics to analyze data from a software development project - [K2st_U5]
5. is able to critically evaluate the results of empirical studies in the area of software engineering (e.g., evaluate threats to validity) - [K2st_U6]
6. is able to experimentally evaluate the usefulness of recent tools and methods, an software products - [K2st_U9]
7. is able to use programming language (e.g, R) and software libraries dedicated to data analysis - [K2st_U10]
8. is able to apply systematic literature review to find related works for further exploration - [K2st_U16]

## Social competencies:

1. understands the importance and need of conducting empirical research to develop and evaluate methods and tools supporting software development - [K2st_K2]
2. understands the necessity of being honest while describing the results of scientific research - [K2st_K3]
3. is aware of the importance of ethical fairness while conducting empirical research (e.g., how to handle sensitive data). - [K2st_K4]

## Assessment methods of study outcomes

Formative assessment:

- based on the answers provided by students during the seminars,
- based on the regular assessment of the current status of research projects.

Summative assessment:

Performed based on two criteria (the weighted average percentage points):

- conducting a research project and presentation of its results during the seminar (0-100%, weight 0.5)
- knowledge test covering experimental software engineering and quality management (0-100%, weight 0.5)

The final grade is determined using the following scale:

- (90%, 100%] ? 5.0
- (80%, 90%] ? 4.5
- (70%, 80%] ? 4.0
- (60%, 70%] ? 3.5
- (50%, 60%] ? 3.0
- (0%, 50%] ? 2.0

## Course description

The course includes seminars and project classes.

During the seminars students learn and discuss about quality management and experimental engineering. A part of the seminar classes has a form of showcase or individual tasks that are performed by students. The following topics are covered in details:

? Quality Management

o quality management (definition of quality, importance of quality, cost of quality),

o continuous improvement paradigm (Plan-Do-Check-Act, TQM),

o quality management systems and ISO 9000 (definition of quality management system, the structure of ISO 9001, the quality management principles in ISO 9001),

o assessment of processes maturity based on CMMI and SCAMPI,

o good practices of service management with ITIL,

o Reviews and inspections (definition of review and inspection, inspection and review processes and their results).

? Experimental software engineering

o empirical research in software engineering (the role of empirical research in evaluation of tools and methods used in software engineering; relationships between observations, laws, and theories; formulating hypotheses and research questions; quantitative and qualitative methods),

o measurement scales (definition and properties of nominal, ordinal, interval, and ratio scales; types of measurement errors),

o controlled experiments (the goals of controlled experiments; experiment definition; context selection; formulating experiment hypotheses; variables selection: dependent and independent variables; sampling; experiment assumptions; data collection; data validation with the use of statistical methods; data visualization and analysis of probability distributions; testing hypotheses with statistical tests; power analysis; software tools supporting the analysis of the experiment data; interpretation and analysis of the results; classification of threats to validity),

o case studies (goals of cases studies; planning a case study; data and evidence collection; analysis of the data collecting within case study; reporting the results of case study),

o meta-analysis (the goals of meta-analysis; systematic literature reviews; planning and preparation of the review protocol; performing a review; documenting results of review),

o surveys (goals of surveys; types of surveys; preparing surveys; evaluating a survey instrument; the analysis of survey results),

During the project classes? student is running a research project that has to employ at least one of the following empirical methods: controlled experiment, case study, survey, or meta-analysis. The goal of each project is to find an answer to a given research question. The results of the project are described in a report and they presented during the seminars.

## Basic bibliography:

1. C. Wohlin, P. Runeson, M. Host, M. Ohlsson, B. Regnell, and A. Wesslen: Experimentation in Software Engineering: An Introduction, Kluwer Academic Publishers, 2000.

2. Gordon G. Schulmeyer: Handbook of Software Quality Assurance, ISBN-13: 978-1596931862, Artech House Publishers, 2007.

## Additional bibliography:

1. Ochodek, Miroslaw, et al. Improving the reliability of transaction identification in use cases. Information and Software Technology 53.8 (2011): 885-897.

2. Ochodek, Mirosław, and Sylwia Kopczyńska. Perceived importance of agile requirements engineering practices?A survey. Journal of Systems and Software 143 (2018): 29-43.

## Result of average student's workload

| Activity | Time (working hours) |
|---|---|
| 1. participating in project classes and seminars | 60 |
| 2. preparing assumptions of research project, its execution, preparation of the report, and presentation of the results | 15 |
| 3. preparing to the knowledge test | 10 |
| 4. studying literature / learning aids | 15 |

## Student's workload

| Source of workload | hours | ECTS |
|---|---|---|
| Total workload | 100 | 4 |
| Contact hours | 60 | 2 |
| Practical activities | 75 | 3 |