THESIS SUPERVISOR'S REPORT

I. IDENTIFICATION DATA

Thesis title:	**Investigating the Potential Development of Antimicrobial Resistance Towards Photoactive Nanoparticles Under Illumination**
Author's name:	**Markéta Bařinková**
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Circuit Theory
Thesis reviewer:	David Rutherford
Reviewer's department:	Physics

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	**challenging**

How demanding was the assigned project?

This experimental-based project was demanding with respect to the amount and structure of laboratory work involved. There were preliminary experiments to establish certain parameters which were then incorporated into two separate experiments, each consisting of three re-exposure experiments. Each individual re-exposure experiment needed 3 consecutive days for completion, and subsequent experiments were mostly carried out the following week but also sometimes without pause over the weekend. Also, study of background information was difficult due to the limited availability of similar research.

Fulfilment of assignment	**fulfilled**

How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.

The thesis successfully investigated the possible development of resistance by bacteria towards photoactive antibacterial nanoparticles under illumination. Bacteria that were re-exposed to ZnO became more sensitized towards treatment, once with illumination and once in dark. The data will be prepared for publication this year.

Activity and independence when creating final thesis	**A - excellent.**

Assess whether the student had a positive approach, whether the time limits were met, whether the conception was regularly consulted and whether the student was well prepared for the consultations. Assess the student's ability to work independently.

The student completed all the laboratory work to a very high standard within the pre-planned schedule and submitted the written thesis before the deadline. Training was completed during the preceding semester project; therefore, the concept was already fully understood and much of the laboratory work was performed without supervision. Consultations were regular (weekly – after each experiment) and the final thesis was written independently and did not require any major revision.

Technical level	**A - excellent.**

Is the thesis technically sound? How well did the student employ expertise in his/her field of study? Does the student explain clearly what he/she has done?

By the standards of a master's project, the submitted thesis has a high professional level. The student performed technically difficult procedures during the experiment that required a high degree of accuracy (in order to reduce/eliminate contamination), and then successfully applied a number of statistical methods from her field of study to the data collected from the experiments. The analyzed data was presented clearly in a number of different graphical formats.

Formal level and language level, scope of thesis	**A - excellent.**

Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?

The submitted thesis is very well presented, grammatically excellent with difficult concepts clearly explained using high quality English language. The scope of the thesis is extensive with detailed concepts from different scientific disciplines such as microbiology, chemistry and physics.

Selection of sources, citation correctness	A - excellent.

Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?

The number of references that were used in the preparation of this thesis was more than satisfactory (> 50). Also, there was a variety in the source of reference, ranging from scientific journal articles to textbooks and chemical data sheets, all of which created an original thesis that, as best I can see, is free from plagiarism.

Additional commentary and evaluation (optional)

Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.

The assignment was challenging and required a lot of time management due to the importance of the extensive experimental workload. The student managed all the experiments very professionally with a high degree of competence, beyond what one would expect from someone with equivalent experience. This allowed for two separate experiments to be performed, which meant better comparisons and conclusions could be made. The fact that no resistance development towards nanoparticle re-exposure was observed is an important finding considering resistance towards conventional antibiotics is increasing. Currently, there is limited information regarding resistance development towards photoactive nanoparticles in the literature. Therefore, the results from this thesis will clearly add to the current knowledge in the field and we plan to prepare the data for publication.

III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

The pro-active approach by the student towards both the practical and theoretical aspects of the project deserves recognition. The quality of the experimental work was very high, and the generated results were well presented and scrutinized statistically. In addition to this, it must be noted that the student designed and created equipment to use in the experiments (i.e. 3-D printed cap). This work was not part of the original project, but the student volunteered and the outcome greatly improved the accuracy and reproducibility of the illumination experiments. This highlights the student's ability to identify a problem, design and develop customized apparatus to address the problem, and finally to create something of sufficient quality that solves the problem, all with the aim of improving experimentation.

It is for these reasons that I award the thesis **A - excellent.**

Date: **23.5.2022**   Signature: