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SUPERVISOR'S OPINION OF FINAL THESIS

I. IDENTIFICATION DATA

Thesis name:	**Sample handling and proportional dilution for cell exhaust exposure in a toxicological incubator**
Author's name:	**Rajesh Rameswaran**
Type of thesis :	M.S. thesis
Faculty/Institute:	Faculty of Mechanical Engineering
Department:	Department of Automotive, Combustion Engine and Railway Engineering
Thesis supervisor:	Michal Vojtíšek
Supervisor's department:	Department of Automotive, Combustion Engine and Railway Engineering

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	**Challenging**
Evaluation of thesis difficulty of assignment.	

The thesis topic is a part of a larger interdisciplinary research project. The realization of experiments builds on theoretical background gained in Experimental Methods class and practical experimental skills gained throughout the internship.

Satisfaction of assignment	**Fulfilled**
Assess that handed thesis meets assignment. Present points of assignment that fell short or were extended. Try to assess importance, impact or cause of each shortcoming.	

The core of the assignment consisted of taking part in the design and fabrication of sample handling and preparation system to be used with a toxicological incubator, where cell cultures are exposed to diluted and conditioned exhaust under defined and controlled conditions. Mr. Rameswaran's assignment was to design parts relevant to the incorporation of humidifiers, to temperature, humidity and flow measurement, sample flow control, to evaluate different dilution systems, to carry on experimental evaluation of particle losses in a membrane humidifier, and to take part in the experimental campaign. As assigned, these tasks were accomplished at the proof-of-concept level and successfully validated by experiments. In addition, he has written software to control, and collect data from, various sensors, and performed computational fluid dynamics simulation of the flow in a flow divider.

Activity and independence when creating final thesis	**A - Excellent**
Assess that student had positive approach, time limits were met, conception was regularly consulted and was well prepared for consultations. Assess student's ability to work independently.	

Mr. Rameswaran has participated in the design and testing of the experimental apparatus and in a rather extensive matrix of laboratory tests. He consulted regularly, discussing intended actions and progress of ongoing work, and exhibited excellent organization and communication skills when planning consultations, which were mostly very productive. Mr. Rameswaran has worked both independently on his own and as a part of the team. On the team tasks that he has agreed to manage, he was an excellent leader. He carried assigned tasks diligently, recognized and communicated emerging problems, was respectful to his colleagues, and they enjoyed working with him.

Technical level	**A - Excellent**
Assess level of thesis specialty, use of knowledge gained by study and by expert literature, use of sources and data gained by experience.	

The overall context of the experimental work – creation of a novel test apparatus and carrying on tests – required gaining at least a working knowledge of many highly specialized concepts, including engine test bench operation, exhaust sampling and dilution, measurement of particulate matter using several advanced instruments, and the working of a toxicological incubator. Mr. Rameswaran has demonstrated the ability to research and use background information from multiple sources. Considering the complexity and specialty of the subject, the writing throughout the thesis is remarkably good.

Formal and language level, scope of thesis	**B – very good**
Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.	

The scope of the thesis is appropriate, key concepts, background, instrumentation, experiments and results are described

well and efficiently. Established terminology and notations are adhered to. The text is comprehensible and reasonably well organized. The language level is excellent. Some abbreviations deserve first explanation in the text (Bharat Stage VI, a standard used in India).

Selection of sources, citation correctness	B – very good

Present your opinion to student's activity when obtaining and using study materials for thesis creation. Characterize selection of sources. Assess that student used all relevant sources. Verify that all used elements are correctly distinguished from own results and thoughts. Assess that citation ethics has not been breached and that all bibliographic citations are complete and in accordance with citation convention and standards.

In addition to background literature available within the project team, Mr. Rameswaran has found and used additional literature sources which were appropriate, well chosen. Citations are well documented, including the use of figures which are part of a journal manuscript of which the student is one of the authors. Some statements are not attributed to the primary sources, but to other work, in many cases, to the mentioned manuscript jointly prepared by the project group. This can be partly justified by the interdisciplinarity of the project in cases where the presented background is outside of the author's field.

The formatting of the references is inconsistent. At least one reference cited is not on the list (Mohsin 2018), while at least one reference in the list is not cited (Raza 2018).

Additional commentary and evaluation

Present your opinion to achieved primary goals of thesis, e.g. level of theoretical results, level and functionality of technical or software conception, publication performance, experimental dexterity etc.

III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

Mr. Rameswaran has demonstrated, throughout his internship and thesis work, excellent practical engineering skills in engine testing / emissions measurement / advanced particle measurement instrumentation areas, and has been a valuable member of the experimental team.

The thesis provides an overview of a rather complex field of particle emissions from contemporary spark ignition engine, including measurement, sampling, and health effects of combustion generated particles. The assignment was a diverse mix of mechanical design, software engineering, and data analysis, and was carried to the satisfaction. There are relatively few deficiencies, such as in the list of references.

The tasks carried on by Mr. Rameswaran were commensurate to early stages of doctoral research, differing from it mainly by the extent of the assignment.

Based solely on the thesis, I would classify it with a grade B – Very good. Considering all aspects of Mr. Rameswaran's work relevant to the thesis, I consider his work to be excellent.

Overall, I classify the thesis with grade A – Excellent.

Questions:

Please suggest an example of industrial flow controllers that could be used in lieu of the rotameters. Please discuss the main advantages or disadvantages.

Date: **27.8.2019**   Signature: