ASSESSMENT PROTOCOL GRADUATION PROJECT MSc STNF (version December 2022)

This protocol replaces the protocol Graduation Project MSc. STNF approved on 17/09/2019

The assessment of a Graduation Project Science & Technology of Nuclear Fusion (STNF) comprises the following aspects:

(1) **Project duration:** regulations regarding the duration and finalization of the project

(2) **Graduation committee**: composing a three-member committee along the guidelines

(3) **Graduation committee meeting**: presentation and defense, evaluation afterwards

(4) **Assessment procedure & rubrics, assessment form**: determination and communication of the grades

1. **Project duration.** On the Graduation Project registration form, the end date of the Graduation Project is entered, as agreed between the academic supervisor and the student, using as a rule that a 45 EC project corresponds to an equivalent effort of 30 fulltime workings weeks. It is the express intention that the project, including the submission of the final report and the final presentation, is completed by this end date. If due to circumstances, e.g. because there was a delay in experiments outside the control of the student, academic supervisor and student agree that the end date has to be shifted, a request to examination committee NF should be made. Should the student not succeed in submitting the final report before the agreed deadline, the following rules apply: Until 8 full time working weeks after the agreed end date, the student can still submit the final report of the Graduation Project. If the student fails to do so, the academic supervisor is obliged to mention this delay in the deliberation of the graduation committee. The committee shall take this delay into account in the grading. The student must submit a motivation or explanation in writing for the delay to the graduation committee.

2. **Graduation committee.** The Graduation Project STNF consists of at least 3 examiners (4 examiners are allowed in consultation with student or when requirements below are not met with 3 examiners); The first member is the academic supervisor, also TU/e examiner, and chair of the committee (double degree: this can deviate, coordinate with the rules of the other program). At least two additional members are from the scientific staff of TU/e, of which one a TU/e professor or associate professor. The examiners in the graduation committee represent at least two of the three faculties Applied Physics, Mechanical Engineering or Electrical Engineering. Experts and daily supervisors (e.g., company supervisor, PhD, postdoc) without an examination qualification may act as an advisor. In case of a double degree graduation committee, please check article 4.5 in the Examination Committee Regulations.

3. **Graduation committee meeting.** Before the meeting can take place, the student fulfills the exit criteria, i.e., the basic requirements for the report, presentation and the science communication product which can be found in appendix 1 of this document, checked by the academic supervisor. Failing any of them is ground for rejection of the report or the science communication product, or, in the case of failing the criteria for the presentation, for the postponing of the graduation committee meeting. The student sends the abstract, report and science communication product (SCP) to the committee members and secretary of Nuclear Fusion at least 5 working days before the meeting. At the meeting, the student delivers a presentation of 15 minutes (double degree: this can deviate, coordinate with the rules of the other program) followed by a discussion of approx. 10 minutes. Thereafter, in a meeting with the student and committee only, the defense takes place lasting approx. 1 hour. At the end, the evaluation takes place within the committee.

4. **Assessment procedure & rubrics.** The assessment has 4 components, (A) Report, (B) Scientific communication (presentation & science communication product), (C) Defense, (D) Execution of the work. Committee members use the rubrics to determine the component grade. Before the meeting, the academic supervisor has determined the grade for implementation of the work itself (D) in consultation with the daily supervisor and/or other advisors. At the start of the evaluation, all committee members should individually determine their grades for components (A-C). After the discussion, the grades for the four components are decided on a scale of 0 to 10, in 1 decimal. The rubric (see appendix 2) will give a score in each of the four components. The average of this will be the final grade for the Graduation Project, rounded to a half-integer number. In case this score is exactly in between a half integer and an integer number, the grade for the execution of the work (D) determines the rounding.
The student passes when the final grade (excluding bonus/malus point) is ≥ 6.0, and the report is ≥ 6.0. After the

defense and evaluation, the academic supervisor explains and motivates the grades to the students within the committee meeting. This will be documented on the assessment form, see below.
The graduation committee has the option to deviate from the mathematical outcome of the rubrics-based grading by adding or subtracting up to 1 point. This allows the possibility to appreciate excellence in one or more important aspects which cannot be dealt with in the simple rubrics approach without introducing complicated weighting schemes or devising a very detailed rubric. To award this extra bonus/malus point, the committee should decide unanimously on this.
Assessment form. The grades of the four components and final grade should be registered on the assessment form. The academic supervisor includes a concise written motivation per component, based on the discussions and input of the committee members. In case the final grade is 6.0 or 10.0 or in the case of awarding the extra bonus/malus point, a separate motivation should be given. The academic supervisor sends the abstract, report, SCP, the signed TU/e code of scientific conduct for the master's thesis form, completed assessment form + motivation to the student, Secretary Fusion, CSA, as well as to the committee members, within 5 working days after the graduation committee meeting. This may be done by the Secretary Nuclear Fusion as well but the Academic Advisor remains responsible).
The grades will be processed by CSA in Osiris. If the student doesn't meet the requirements for passing (see above), the student fails the Graduation Project and the same procedure as described before (sending completed assessment form to student, Secretary Fusion, CSA, student and committee members, grades in Osiris) applies. The student will enter a retake procedure. Together with the academic supervisor, the student will agree on what actions need to be taken to improve the project, e.g., rewrite the report and/or deliver the presentation and/or defense again, in a subsequent meeting with the graduation committee.

ASSESSMENT FORM GRADUATION PROJECT MSc STNF (version September 2022)

1. Surname student + initials:
2. Student ID number:
3. Date of assessment:
4. Start date Graduation Project:
5. Expected end date *(as indicated on the registration form):*
6. Course code and corresponding study load: 3NFA45 (45 EC)
7. Name of Masters' program(s): Science and Technology of Nuclear Fusion
8. Capacity group / research unit: Science and Technology of Nuclear Fusion (FUSION)
9. Academic supervisor:
10. Title Graduation Project:
11. Committee members + advisors:

COMMITTEE MEMBERS		
NAME EXAMINER + CAP. GROUP. + DPT	ROLE	TU/e (Y/N)
1.	Academic supervisor, chair	Y
2.	AP/ME/EE	Y
3.	AP/ME/EE	Y
4.		
ADVISORS	ROLE	AFFILIATION
1.		
2.		

12. Grades (components in 1 decimal, final grade 1/2 integer):

Report (25%)	Presentation (25%)	Defense (25%)	Implementation (25%)	FINAL GRADE*

* If the report is graded <6.0, the final grade will be NMR (NVD). In case the final grade is exactly in between a half integer and an integer number, the grade for the implementation of the work determines the rounding.

13. Additional requirements

☐ Motivation 4 components included on separate sheets (approx. 5 sentences / component); optional additional motivation for final grade (compulsory when grade is 6.0 or 10.0).

☐ The grade of the report is ≥ 6.0

☐ Composition graduation committee according to the guidelines

☐ Title page report according to the TU/e guidelines

☐ Project in accordance with TU/e Code of Scientific Integrity

☐ Fraud and plagiarism check on report (Ouriginal) and science communication product (if possible) has been conducted (may be carried out by the Secretary Nuclear Fusion but Academic Advisor remains responsible that this is done properly)

☐ Completed assessment form + motivation (pdf) to student, secretary Fusion, committee members

Confidentiality (see guidelines Graduate School for more information):

☐ Open access (not confidential)
☐ Temporary embargo of 2 years, including public summary.
☐ Embargo of 2-5 years, including public version. A request from the company must be submitted to the Dean AP at least two weeks before the graduation meeting takes place.

Date of publication after confidentiality period:

Signature of Academic supervisor

Date of signature

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To be filled in by the academic supervisor. Feedback of the additional committee members on the components is incorporated. Motivation on the 4 components included (approx. > 5 sentences / component). Additional motivation for final grade is compulsory when final grade is 6.0 or 10.0 and in case of awarding the bonus /malus point)

Feedback on Report (25%)

Feedback on Scientific Communication (25%)

Feedback on Defense (25%)

Feedback on Implementation of the work itself (25%)

Additional motivation (compulsory for grade 6.0 or 10.0 and in case of bonus/malus point)

Appendix 1: EXIT CRITERIA GRADUATION PROJECT MSc STNF (version September 2022)

On this page, the exit criteria for the report, the essay and the presentation will be pointed out. The academic supervisor should filter these already out before the commission sees the report, essay or presentation. These criteria are:

- Report/Thesis
    1. English: Sufficiently understandable. Grammar and spelling should be to a level that the report can be understood without any confusion related to the text.
    2. Neatness: Overall neatness acceptable, readable fonts, readable figures. A minimum level of care in preparation is required. In any case, the (lack of) neatness may not hinder the clarity of the presentation and stand in the way of assessment
    3. References: Correct literature referencing, Correct attribution of figures when these are not self-made
    4. Plagiarism: No instances of plagiarism, a check will be done.
    5. Basic correctness: Obvious, serious incorrectness is not acceptable

- Science Communication Product (from 17/09/2019)
    1. English sufficiently good/ understandable
    2. Basic neatness, readable fonts and figures (if applicable). Overall sufficient care in preparation.
    3. Correct referencing
    4. No plagiarism (check via original)
    5. Length: the consumer should not need more than 10 minutes (max!)
    6. On-Topic: (elements of) the graduation research should be central
    7. Must place the work in societal context: motivation, meaning, impact, possible use
    8. Must indicate the targeted audience
    9. Must be correct: Where simplification is called for, it may not lead to scientific incorrectness.
    10. Must feature the students name and affiliation (TU/e)

- Presentation
    1. English sufficiently good/ understandable
    2. Slides incl. figures readable
    3. Overall sufficient care in preparation: a speaker must not waste the time of the audience due to insufficient preparation.

APPENDIX 2. RUBRIC. GRADUATION PROJECT MSC. STNF* (version September 2022)

		Items considered	6 (sufficient)	10 (excellent)
1. Report	**Scientific Quality**	Context of the work	* being able to describe motivation for the work	* Placing the work in context of, critical review of own work and results, helicopter view, outlook
		Scientific reasoning	* Scientific reasoning is free of errors	* Soundness of scientific reasoning. Separation of results (measurements, results from modelling, theoretical results) from interpretation.
		Theoretical treatment	* In theoretical work: being able to reproduce / summarize derivation from literature, describing assumptions and defining parameters	* In theoretical work: rigor.
		Description experimental setup (if applicable) and treatment of data	* In experimental work: Description of the experiment and setup, plotting results in figures	* In experimental work: Treatment of errors – error estimation, error breakdown, error bars in figures. And adequate description of the experiment.
		Model description/assumptions/validation	* In modelling/computational research: model description and discussion on validity of results	* In modelling/computational research: model description and assumptions, implementation, validation
		separation own vs existing results	* Compare own results with what is found by others	* Clear separation of own work from existing knowledge
		discussion relevant literature	* being able to find the and cite the leading papers in the field	* Critical discussion of relevant literature
		Evaluation of own work	* add discussion section/paragraph in report.	* Critical evaluation of own work
	Reporting Quality	information in report: what is done, why is it done, how is it done. What is result?	* The report should at least have a motivation, research question (or design goal) describe the method, give results and ands with a conclusion	* The report tells the reader exactly what was done, why it was done, how it was done, and what the result was
		Structure of the report	* The basic structure has as minimum component the items listed below	* Overall structure of the report is adequate and logical.
		Completeness of report: does it contain the following parts:	* The report contains the following parts:	* The report contains the following parts:
		o Abstract:	o Abstract: gives least aim and result	o Abstract: informative and concise on aim and results
		o Introduction: with background, motivation, statement of the problem, breakdown of the problem, clear description of the approach. Literature overview	o Introduction: Background, Motivation, statement of the problem, Description of the approach	o Introduction: Background, Motivation, statement of the problem, breakdown of the problem, clear description of the approach. Adequate review of relevant literature
		o Theory (when applicable)	o Summary of theory or background knowledge used in the rest of the report	o Theory (when applicable): decribing existing knowledge and building further on that
		o Method/Experiment	o Description of Method/Experiment	o Method/Experiment: clear description fo experiments or methods, including the motivation what is to be learned form each experiment
		o Results	o Results	o Results: clear presentation of results
		o Interpretation		o Interpretation: description and discussion of what can be learned from the results
		o Summary and Discussion	o Summary and Discussion	o Summary and Discussion (if applicable: application potential?)
		o Conclusion: relate back to the research question/problem		o Conclusion: relate back to the research question/problem
		Use of figures	* Use of figures : contain the main results/information and have caption	* Use of figures – adequate, to the point, well chosen
		Conciseness		* Conciseness: not too much, not too little.

		Items considered	6 (sufficient)	10 (excellent)
2. Communication	**Presentation**	Clarity and structure	*logical structure: problem definition, method, results, conclusion	* Overall clarity, clear story line, logical structure
		scientific argumentation, leading to conclusions	* no inconsistencies in argumentation	* Convincing scientific argumentation, leading to conclusions that are supported by the evidence presented
		Scientific substance.	* scientific substance: presentation of results that can be verified	* While focussing on the story line, still giving sufficient scientific substance. Conveying that every statement is based on research and can be backed up with more evidence or literature if asked.
		Adequate introduction	* in introduction motivation and problem definition is addressed	* Adequate introduction, i.e. not too short but efficiently getting to the point
		Balance between introduction, exposition of the work itself, conclusions, and discussion/reflection.	* introduction, results, conclusion and discussion are all addressed	* Good balance between introduction, exposition of the work itself, conclusions, and discussion/reflection.
		Selection of the results	* present results relevant for problem	* Good selection of the essential results that underpin the conclusions
		Convincingness	* Student makes clear he stands behind his conclusion	* That the student manages to convince that this is good work, both in terms of enthusiasm but also scientific explanation
		Handling of the questions in the discussion	* student is able to answer question directly related to his own work, on how he has done it.	* Handling of the questions in the discussion
		Timing of the presentation	* Within 20 % of the allocated time	* Within the time constraints
	Science Communication Product	· Is it clear what the message is?	* There is a message, but it is not very clear and/or mixed with other messages	* The SPC is suitable for the indicated target group
		· Does it address the selected audience?	* Some consideration to the intended audience is given, but this is not used effectively	
		· Is the chosen form effective, fitting the	* The form is in itself OK, but not particularly suitable for the purpose	
		· If graphics are used, are they right for the purpose and audience: do they support the message effectively and are they attractive?	* The graphics meet the minimum technical requirements but are not effective in supporting the message	
		· Is it original, imaginative? In form, content (original arguments), or both.	* The form is not particularly original in any way	* The SPC has a clear line and message
		· Does it effectively deliver the message to the intended audience?	The sum of the above: orm, graphics, and presentation are each acceptable but do not effectively work together to deliver a message	* The SPC makes a compelling reading

		Items considered	6 (sufficient)	10 (excellent)
3. Defence		Mastery of the thesis research	* Able to discuss the items of direct relevance to the project. On how the student performed the work	* Showing good mastery of all aspects of the thesis research, ability to defend all parts of the research.
		Ability to engage in a scientific debate	* Being able to defend the main conclusion of the report	* Ability to engage in a scientific debate, standing one's ground when challenged, conceding when not knowing something.
		Ability to perform scientific reasoning on the spot	* Ability to give a scientific reasoning involving the main aspects of the work.	* Ability to think on one's feet when confronted with a new idea or fact, integrate it in the discussion of the work; ability to perform scientific
		Ability to discuss the place of the research project	* Being aware of how the project fits in the bigger picture of the research field.	* Ability to discuss the place of the research project in the larger frame, its impact and potential.
		Level of (fusion-relevant) scientific knowledge in a broader sense	* can reproduce the basics of the fusion canon	* has a general (fusion-relevant) scientific knowledge in a broader sense.

		Items considered	6 (sufficient)	10 (excellent)
4. Execution of the work	**Scientific approach and level**	· Depth and Breadth/scope/ground covered. · Ability to come to an articulation of the research question (based on literature) · Scientific level achieved · critical attitude; Independence	* The student knows the basics of the specific topic his project is about * The student can define a research question based on the project task * the work is free of basic errors, and the conclusion is supported by the results presented. * the student has a critical attitude towards its own results and conclusions (by discussing the validity and reliability)	* large Depth and Breadth/scope/ground covered. (it is really the combination that matters) * Clear articulation of the research question (based on literature) * High Scientific level achieved, of PhD quality * (Justified) critical attitude to literature and own results; Independence in the formation of scientific ideas.
	Creativity/initiative	· Originality: of the problem, the method. · Initiative, self-propelledness · Accuracy: verification/validation of each result, calculation, computational step? · Ability to work independently · Ability to find experts and information	* Originality: the student follows the supervisors advise and in a few instatnce demonstrates that he can add new insights * demonstrated some initiative, needs sometimes help but can also work individually * basic errors are absent, but some smaller errors are apparent. Validation and verification has sometimes been doen, but not in a systematic way * needs guidance most of the time, but for some aspects can work independently * When things do not work out and student is advised to check with other experts or in lterature he is able to improve his answer.	* Originality: of the problem, the method. * demonstrated lots of initiative, was self-propelled * demonstrated large accuracy: verification/validation of the results, correct calculations, explained computational steps * worked mostly independently, but also made efficient use of guidance * Found the relevant experts or expertise and did not try to find out everything on one's own
	Project execution and skills	· Project management, speed and planning · Reliability (i.e. whether the student delivers something if promised, and timely) · In the reporting: was the iteration process efficient · Processing of feedback · Collaborative skills/ when appropriate: ability to work in a team · Development of relevant skills: Programming skills, Experimental skills ('golden hands'), Data analysis skills, …	Planning is not delayed more than 25 %, planning contains the main aspects, project managementis done in collaboration with supervisor The student delivers if promised, but needs to be remembered several times. Several interations needed before an acceptable result is obtained feedback is taken note of , but not always processed (in the intended way) student does his part in the team, but will not initiate collaborations him/herself, not active to promote teamwork, but does also not frustrate teamwork has basic skills but does not demonstrate any special skills or skill developped to a higher level	* Good project management: project finished on time, no delays * Reliability, i.e the student delivers if promised, and timely) * In the reporting: the iteration process is efficient, only 1 iteration needed * The student took note of feedback and used this efficiently * Good Collaborative skills, teamplayer demonstrates some special skiils, at a higher level than the average student.

* ≤ 5 = fail, 6 = sufficient, 7 = satisfactory, 8 = good, 9 = very good, 10 = excellent