UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Engineering, Built Environment and Information Technology

Fakulteit Ingenieurswese, Bou-omgewing en Inligtingtegnologie

School of Engineering

Department of Mechanical and Aeronautical Engineering

Design Project MOX410

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DEPARTMENTAL STUDY GUIDE

This study guide is a crucial part of the general study guide of the Department. In the study guide of the Department , information is given on the mission and vision of the department, general administration and regulations (professionalism and integrity, course related information and formal communication, workshop use and safety, plagiarism, class representative duties, sick test and sick exam guidelines, vacation work, appeal process and adjustment of marks, university regulations, frequently asked questions), ECSA outcomes and ECSA exit level outcomes, ECSA knowledge areas, CDIO, new curriculum and assessment of cognitive levels. It is expected that you are very familiar with the content of the Departmental Study Guide. It is available on the Department's website.

English:
https://www.up.ac.za/media/shared/120/ZP_Resources/Noticeboard/departmental-studyguide-eng-2019_version29-jan2019.zp167517.pdf

Afrikaans:
https://www.up.ac.za/media/shared/120/ZP_Resources/Noticeboard/departementele-studiegids-afr-2019_weergawe29-jan2019.zp167518.pdf

Table of Contents

List of abbreviations

CAD	-	Computer Aided Drawing
CDIO	-	Conceive – Design – Implement – Operate
ECSA	-	Engineering Council of South Africa
ELO	-	Exit Level Outcome
DPP	-	Design Project Proposal

1. INTRODUCTION

MOX410 Design project gives the student the opportunity to demonstrate his/her competency to perform creative design and synthesis of components and systems relating to the mechanical engineering discipline. The student demonstrates his/her competency through completing a major design problem typical of that which the student would be given in an employment situation shortly after graduation. The student also has to demonstrate his/her competency to communicate with engineering peers as well as the community at large.

In order to successfully complete this module, the student has to select the applicable knowledge gained throughout the undergraduate curriculum, as well as obtain additional information on unknown subject areas, and apply it to solve the design problem at hand. Therefore, the most important player in this module is the student.

This module carries a weighting of 16 credits, implying that the student should spend some 160 hours to complete the design project. The average student should therefore spend about ten hours per week on this module during the semester.

2. SCOPE AND AIM

The scope and aim of MOX 410 Design project is given in this section.

2.1. Scope

Each student is given a design project that has to be completed during the first semester of their final study year. The project should take about 160 hours to complete. Each project is associated with a lecturer, who acts as the client, and who has contracted the student to do the project. The student has to obtain the user requirements from the client and from that deliver a complete design that will satisfy the client's requirements. The process that the student will follow to solve the design problem will consist of, but is not limited to, setting up design specifications, conducting a functional analysis, generating concepts, selecting the best concept and performing the necessary design calculations to ensure that the design meets specifications and comply with relevant standards. The deliverables of the project are a written report documenting the entire process and a set of drawings required to manufacture the designed components and/or system(s) (For full details on the deliverables please see 9.3. Deliverables).

2.2. Aim

After completing this module, the student should be able to do the following:

1) Execute a typical design task, as it is generally found in industry, in order to satisfy the user requirements in a safe and economically viable manner, taking proper care of legal, environmental and social aspects.
2) Apply the knowledge of the subjects that the student has already studied in a meaningful way in order to solve the problem.
3) Acquire new knowledge that the student does not possess as yet, but which is needed for the execution of the project.
4) Communicate clearly and effectively, orally and in writing, to engineering peers and the general community on the design processes followed.

5) Prepare engineering drawings and required documentation with the necessary clarity so that components and/or system(s) can be manufactured without any misunderstanding.

3. ROLE OF MODULE COORDINATOR, CLIENT, DISCIPLINE SPECIALISTS AND ASSESOR

This section gives information on the roles of the module coordinator, client, the discipline specialists and assessor.

3.1. Module coordinator

The person responsible for the organisation and administration of this module is:

Dr Lukas du Plessis
Office : Room 10-17, Engineering Building I
Tel : 012 420 2431
Email : lukas.duplessis@up.ac.za

As coordinator of the module, Dr Du Plessis is available to the students for administrative and organisational queries regarding this module. With specific problems regarding the student's design project the student should consult with his/her client during the scheduled meetings.

3.2. Client

The topic, to which each student is assigned, has a lecturer who represents the client for whom the design project is being done. The client should be considered as a non-technical person. The lecturer, acting as a client, may give guidance where required but it is the student's responsibility to ask the relevant questions in order to ensure that the student understands the client's requirements and the project outcomes, thereby ensuring that the student will be able to complete the design project to the satisfaction of the client and the module's outcomes.

3.3. Discipline specialist

Discipline specialist will be available to students during the detail design phase. The discipline specialist will be available to assist students with questions on areas such as dynamics, structures, heat transfer and thermodynamics. It is the student's responsibility to perform the necessary detail calculations with discipline specialist merely providing guidance and assistance to questions from the students.

3.4. Assessor

Lecturers will be assigned to topics to act as assessors. Assessors will assess and give feedback to students on their Design Project Proposals (DPP) and progress report. Assessors will also assess the students' final deliverables.

4. MEETINGS

Meetings with the module coordinator, the client and the discipline specialists will take the form of a 50min group meeting. The meeting schedule for meetings with the module coordinator, the client and the discipline specialist will be posted on ClickUP. Meetings with the assessor will be arranged by the assessor, with the student, if needed.

During the coordinator meetings the students may ask questions relating to administrative and organisational aspects of the module. Coordinator meetings may also be used to provide students with additional info on various aspects of the design process.

Meetings with the Client and Discipline Specialists should be documented by the student using the Meeting Log Card (see Appendix A). Please note that it is not the responsibility of the client to ensure that the meeting log card is signed at each meeting but the responsibility of the student. The Meeting Log Card must be included in the final report (see Appendix E – Guideline for final report).

5. IMPORTANT DATES

The following table lists the important dates of this module. These dates should be used by the student to plan his/her project.

Table 1. Important dates relating to Design Project MOX410

Item / Task / Milestone	Due date	Details / Comments
2nd round of Design topic rankings & allocations	4-8 February 2019	Only applicable to students who were not allocated during the 1st round
Design Project Proposal (DPP)	11-15 February 2019	Clients to make DPP's available and discuss at 1st and / or 2nd client meeting
Progress report	15 Apr 2019 before 08h00 (i.e. 8 AM in the morning)	Electronic submission on ClickUP (see section 8. PROGRESS REPORT)
Select drawings for evaluation	29 April - 3 May 2019	(see section 9.3.2. Manufacturing drawings)
Submission of deliverables	**EXTREMELY IMPORTANT**	
	Reports may be handed in from 20 to 27 May 2019 **Reports must be submitted no later than 16h00 on 27 May 2019**	**What must be handed in:** Two (2) hardcopies (i.e. paper format, ring-bound) of your final report including manufacturing drawings in both copies. (see section 9.3.3. Submission of deliverables) **Venue for hand-in:** Venue for hand in will be announced on ClickUP
	On successful submission of deliverables, students will be requested to submit an electronic version of their reports. This request will be send out after the due date for the final deliverables	
Oral Examination	TBA	Times and venues will be announced on ClickUP (see section 9.4. Examination)
Supplementary examination	TBA	Student to hand in rectified report (see section 9.6. Supplementary examination) Venue for hand in will be announced on ClickUP
Submit supplementary grade	TBA	Internal and external Examiners to submit grade for supplementary examination

6. DESIGN TOPIC ALLOCATION

This section discusses the process that is followed from the defined design projects to the allocation of students to a project.

6.1. Topics

Design topics are defined from the following three research groups:

- Clean energy research group (CERG),
- Centre for Asset Integrity Management (C-AIM) and
- Vehicle Dynamics Group (VDG)

The respective Heads of the Research Groups reviews the list before it is posted on the web page together with the Study Guide. Students must examine the list and then rank the topics on the Project Assignment Website.

6.2. Registration and Allocation

All students register electronically for the module. During the registration process the student will have the opportunity to make his/her selection of the topics he/she prefers. This will be taken into account when the students are allocated to the various topics. Although the Department will try to accommodate the preferred choice of the student, it is not always possible.

Students are allocated to topics on the basis of:

- The number of students that can be accommodated on a topic.
- The student's topic of preference.
- Allocation by module coordinator or Head of Department.

7. DESIGN PROJECT PROPOSAL (DPP)

The Design Project Proposal should be seen as a guidance document in which the client describes the scope of the project.

In the DPP the client gives an overview of the project and gives guidelines on how the student could approach the project. The intent is NOT that the client prescribes in absolute terms how the project must be completed, BUT RATHER to guide the student to work independently. The following aspects can be included in the DPP

1. State the client/user requirements
2. Formulate the problem and objective according to the client requirements
3. Propose a methodology to solve the problem
    a. Identify important issues that needs to be addressed
    b. Identify design tools, etc.
4. Set up a unique project plan should the client deem it necessary deviate significantly from the generic MOX410 - 2019 Gantt chart in Figure 1.

*PLEASE NOTE: **Independent work** is encouraged. Students may therefor deviate from the guidelines in the DPP as long as such deviations are properly motivated and justified in the progress and final reports.*

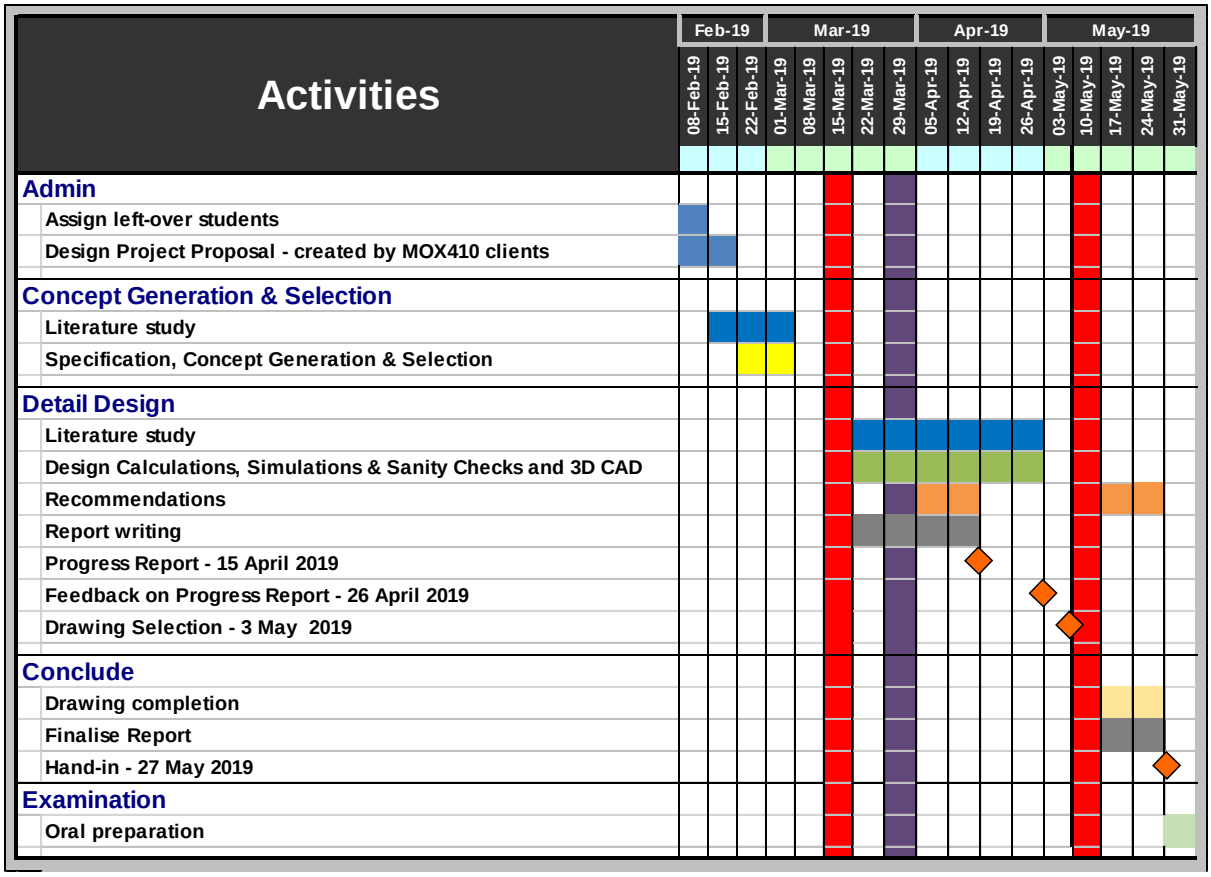

Figure 1: Generic MOX410 - 2019 Gantt chart

8. PROGRESS REPORT

The function of a progress report is to report to the client on the progress that has been made on the project. The report should give the client a clear indication of the status of the project.

The progress report will be used to evaluate and document the progress of the student. The student should use the progress report to reflect on the progress of the project and identify any risks that may have implication on his/her project schedule. The student should have contingency plans for the identified risks in order to manage the risks and its effect on the project schedule. In addition to the general content of the progress report, such as current status, risk and associated contingency plans, etc., the student should include his/her report up-to-date in the progress report.

It is critically important for the student to reflect on the results obtained in the "Detail Design" phase and to make sensible recommendations. It is 100% guaranteed that the selected concept can be improved on. The student MUST reflect and report professionally and honestly on any and all possible improvements that he / she identified and couldn't include in the final design. The student MUST also justify and explain why such improvements couldn't have been included in the final design.

The progress report must consists of:

Part I

- An executive summary page, with the first 2 lines containing the project title and student name respectively. The rest of this page contains an Executive Summary, which focuses on the technical progress to date.
- A project plan in the form of a Gantt chart. The Gantt chart must include the planned and actual timelines, such that lead and lag times are easily visible.
- Reflect on the difference between the originally planned timelines, and the actual timelines. If progress lags behind the envisaged status in the plan, the plan warns that problems are being experienced and re-planning may be required (limited to 1 page).

Part II

- The final report to date

  The student should aim to have completed the following aspects of the design by the progress report due date (see Table 1). These aspects should be well documented and included in Part II of the progress report
  - Literature study (85% complete)
  - Functional analysis (if applicable - 100% complete)
  - User/Design requirements and Technical specifications (100% complete)
  - Concept generation (100% complete)
  - Concept selection (100% complete)
  - Detail Design Calculations, Simulations & **Sanity Checks** and 3D CAD models (±65% complete)
  - Manufacturing analysis, cost analysis, etc. (±65% complete)
  - Recommendations (±35% complete)

Important notice concerning the DPP and progress report:

The progress report is an opportunity for the student to get feedback on the progress to date. If the student does not hand in the progress report or hand-in after the due dates the student will not receive any feedback. Submission of this report will be made via ClickUP. Submission of reports will be open for a number of days prior to the deadline date. Furthermore, student will be able to upload multiple attempts or versions of the report and therefore no excuses will be accepted for student not being able to upload their reports. In addition to the electronic submissions the student's assessor may request a hard-copy of the reports.

9. ASSESMENT

This section gives information to the student on how the student will be assessed in this module. It starts with the exit level outcomes that this module addresses and discusses the deliverables expected from the student as well as the examination process.

9.1. ECSA exit level outcomes of module

This module addresses the following two ECSA exit level outcomes (ELO):

Exit level outcome 3: Engineering Design
Learning outcome: Demonstrate competence to perform creative, procedural and non-procedural design and synthesis of components, systems, engineering works, products or processes.

Exit level outcome 6: Professional and technical communication
Learning outcome: Demonstrate competence to communicate effectively, both orally and in writing, with engineering audiences and the community at large.

9.2. Assessment criteria

The assessment criteria associated with these two exit level outcomes are given below. The assessment criteria will be used to assess whether the student has provided enough evidence that he/she complies with the two exit level outcomes stated above.

Assessment criteria associated with ELO 3:
The candidate executes an acceptable design process encompassing the following:

1. Specifies, generates and selects justifiable concepts in terms of user needs
2. Plans and manages the design process: focuses on important issues, recognises and deals with constraints;
3. Acquires and evaluates the requisite knowledge, information and resources: applies correct principles, evaluates and uses design tools;
4. Performs design tasks including analysis, quantitative modelling and optimisation;
5. Evaluates alternatives and preferred solution: exercises judgment, tests implementability and performs techno-economic analyses;
6. Assesses impacts and benefits of the design: social, legal, health, safety, and environmental;
7. Communicates the design logic and information.

Assessment criteria associated with ELO 6:
The candidate executes effective <u>written communication</u> as evidenced by:

1. Uses appropriate structure, style and language for purpose and audience;
2. Uses effective graphical support;
3. Applies methods of providing information for use by others involved in engineering activity;
4. Meets the requirements of the target audience.

The candidate executes effective <u>oral communication</u> as evidenced by:

1. Uses appropriate structure, style and language;
2. Uses appropriate visual materials;
3. Delivers fluently;

4. Meets the requirements of the intended audience.

The evaluation sheet that comprises of the above assessment criteria, and which is used by the internal and external examiner for assessment, is included in Appendix B.

9.3. Deliverables

The deliverables are the items that will be delivered to the client at the end of a project. The deliverables of this project are as follows and must be submitted before the deadline specified in Table 1:

1) **Final report (including manufacturing drawings)**
   - 2x hardcopies (i.e. paper format), ring-bound.
2) **Manufacturing drawings**
   The manufacturing drawings must be submitted as part of the two hardcopies of the final report mentioned in bullet 1 above

Details on the final report and the manufacturing drawings are given in the two sections hereafter.

9.3.1. Final report

The final report should clearly and professionally communicate the entire process that was followed by the student during the design project. The report should contain sound technical content that will prove to an engineering audience that the necessary consideration were made to ensure that the design will be able to fulfil its intended purpose and function safely. In addition to well documented technical content the report should be written such that it can easily be followed by the general community.
The student should keep in mind that the evaluation of his/her work in this module will be done by an internal and external examiner (generally someone from industry). It is therefore extremely important that the student should compile a professional and well written final report as, besides the presentation, this is the only instrument the external examiner will have to evaluate the student.

A guideline for the contents and layout of the final written report can be found in Appendix E – Guideline for final report.

Part I of the Progress Report (Executive Summary, Project Plan and Reflection) must be included as Appendices in the final report.

9.3.2. Manufacturing drawings

A set of manufacturing drawings, as agreed upon between the assessor and the student, should be included in the design report. The student, is however, not obliged to produce a complete set of manufacturing drawings for a complex system. If a complete set of drawings is required as a deliverable it should be specified as such in the DPP at the beginning of the project and negotiated to allow sufficient time. Alternatively an agreement can be reached for production of such a set after completion of the project. Even though the student is not obliged to produce a complete set of drawings for a complex system the student is encouraged to include sufficient drawings in order to communicate the design. The minimum requirement for the manufacturing drawings is set out below.

The manufacturing drawings submitted as part of the two (2) final written reports and the electronic version must consist of the following:

i. A CAD assembly drawing (on A3 paper) including a parts list.

ii. Four (4) detailed component drawings (on A4 paper) of different non-standard components showing all necessary information (dimensions, tolerances, surface finishes etc.) to ensure successful manufacturing in a typical engineering manufacturing workshop. Two of the four drawings should be freehand drawings. The other two should be done using CAD software. SolidWorks is available to the students in the computer labs, but any other CAD software may be used for which the student has the required legal access.

    NOTE: The originals of the two freehand drawings may be kept by the student with copies thereof included in the two reports.

An assembly drawing must be submitted to the student's assessor prior to compilation of the four detailed component drawings. The assessor will select the four (4) components for which the student has to create detail drawings as described above. This selection process may be done in consultation with the drawing specialist. This selection process is documented using the "Drawings for Evaluation" form in Appendix C. The student should ensure that this form is signed by his/her supervisor. The selection of drawings should be done by the date specified in Table 1.
The signed "Drawings for Evaluation" form must be included in all copies of the final report. Absence of the signed form will result in exclusion of the set of drawings from evaluation and therefore failure of the module.
The drawings are evaluated by the internal and external examiners which may perform the evaluation in consultation with a drawing specialist.

9.3.3. Submission of deliverables

The deliverables must be submitted before the deadline specified in Table 1.
Please note that the deliverables may be handed in at any time prior to the hand in deadline. The hand in deadline should be considered as the last opportunity to hand in and not the only opportunity to hand in. The deadline for the deliverables will not be extended.

No late reports will be accepted

9.3.4. Submission of electronic version of deliverables

On successful submission of deliverables, students will be requested to submit an electronic version of their reports. This request will be send out after the due date for the final deliverables.

9.4. Examination

Once the deliverables have been submitted by the student, a copy of the report is sent to both the internal examiner (i.e. assessor) and external examiners for independent evaluation.

The evaluation by the internal and external examiner is done before the scheduled date of the final examination. During the final examination the student will be given the opportunity to present his work to the internal and external examiner after which the two examiners may ask the student questions about the work or comment on various aspects.

9.4.1 Presentation

The presentation gives the student the opportunity to present his/her work to the two examiners. This is also the instrument whereby the student's oral communication is evaluated. The student has 7-10 minutes for this presentation and may make use of electronic aids such as MS.PowerPoint. The student should be concise and clear in the presentation and should not merely try to condense his written report into an oral presentation. Aspects to which the student can give attention to during the presentation are:

- The problem statement, objective and scope of the project
- Client requirements, how they were converted into design specification, and how they were addressed
- What concepts were considered and how the final concept was decided upon
- State assumptions that were made
- Discuss important design calculations/consideration
- Draw meaningful conclusions

9.5. Calculation of final mark

Marks are awarded using the assessment criteria discussed in section 9.2. Assessment criteria. The evaluation sheet included in Appendix B indicates the corresponding weights for the various criteria.

A subminimum has to be obtained for the following three aspects:

- A subminimum of 50% has to be obtained for ELO 3
- A subminimum of 50% has to be obtained for ELO 6
- A subminimum of 50% has to be obtained for the manufacturing drawings

If a mark of less than 50% for any one of these three aspects is obtained by the student, the student does not pass. In the event that the student does not pass he/she may be granted a supplementary examination on the grounds set out in section 9.6. Supplementary examination.

9.6. Supplementary examination

A supplementary exam may be awarded to a student if,

1) a subminimum of 50% is not obtained for any, or all, of the three aspects as set out in the section above,
2) the extent of the rectifications required to be made to any, or all, of the three aspects are only repairs and not large parts that have to be redone.
3) a final mark of 45-49% is obtained

All supplementary exams will be made known to the student during the examination. The internal and external examiners will, in writing, communicate to the student the required rectifications in order to get the deliverables to comply with the minimum required standard. This is documented using the "Required Rectification(s) for Supplementary Examination" shown in Appendix D. The following must be submitted by the student before, or on, the due date for the supplementary examination as given in Table 1:

- A hardcopy (printed and ring-bound) of the rectified report
- Electronic version of the report in pdf format submitted on ClickUP. The internal and/or external examiner may also request that the electronic version be emailed to them.

In the event that the supplementary examination is accepted by the two examiners the student will be awarded a final mark of 50%. If the rectifications made by the student do not comply, the student fails the module.

Appendix A – Meeting Log Card

This form is available for download on ClickUP.

DESIGN PROJECT - MOX 410

MEETING LOG CARD

Student _____ **Student. no.**_____

Design project _____

Date	Student signature	Supervisor signature	Comments
			(For example, Initial meeting)

ADDITIONAL COMMENTS:

Appendix B – Evaluation Sheet

The evaluation sheet that is used by the internal and external examiners for assessment, as discussed in section 9. ASSESMENT, is shown below. It shows how the two ECSA exit level outcomes are assessed along with the corresponding weights for the various criteria.

UNIVERSITY OF PRETORIA
DEPARTMENT OF MECHANICAL AND AERONAUTICAL ENGINEERING
DESIGN PROJECT MOX 410
INTERNAL and EXTERNAL EVALUATION SHEET – EXAMINATION

DESIGN PROJECT MOX 410: EVALUATION SHEET	**Date:**
Title:	
Supervisor:	
Student:	**Student number:**

ECSA Exit Level Outcome 3: Engineering design		**Max mark**	**Combined**	**Yes**	**No**
1	Is the student able to specify, generate and select justifiable concepts in terms of user needs?	15		√	×
2	Is the student able to plan and manage the design process and able to focus on important issues recognizing and dealing with constraints?	10		√	×
3	Is the student able to acquire and evaluate the required knowledge, information and resources, apply correct principles, evaluate and use design tools?	20		√	×
4	Can the student perform design tasks including analysis, quantitative modeling and optimization?	20		√	×
5	Can the student evaluate alternatives and preferred solution, exercise judgment, test implementability and perform techno-economic analysis (cost analysis, manufacturing costs)?	20		√	×
6	Did the student take into account the impacts and benefits of the design: social, legal, health, safety and environment?	15		√	×
Total for ELO 3 (a *subminimum of 50% (50 out of a 100) is required for ELO 3 in order for the student to obtain a final mark ≥ 50%*)		**100**			
Is the student capable of performing procedural and non-procedural design and synthesis in order to solve an engineering problem? – **<u>if the answer is "NO" a mark of less than 50% must be awarded</u>** for ELO 3				√	×

ECSA Exit Level Outcome 6: Professional and General communication		**Max mark**	**Combined**	**Yes**	**No**
Final report (Written communication)					
1	Did the student communicate the design logically – can the reader follow the design detail and methodology?	15		√	×
2	Was a literature study properly conducted and properly reported on and were the right conclusions drawn from the literature and background study?	15		√	×
3	Is the report properly laid out, with proper language, grammar and general appearance?	10		√	×
4	Does the average reader understand the problem and why work was done?	10		√	×
5	Is everything defined and does the reader have a good idea what the design project was all about?	10		√	×
6	Are sensible conclusions and recommendations made in the report?	10		√	×
	Subtotal for Final report	**70**			

Drawings (Written communication)										
The grades awarded by the drawing specialist may be used as a guideline										
	Assembly drawing									
7	Sections & enlargements						5		√	×
8	Part list						2		√	×
9	Item numbers						2		√	×
10	Main dimensions						3		√	×
	Detail drawings	Breakdown for each detail drawing	CAD 1	CAD 2	Hand 1	Hand 2				
11	Dimensions	5					20		√	×
12	Material specification	1					4		√	×
13	Surface finishes	2					8		√	×
14	Geometric tolerances	2					8		√	×
15	Fits	2					8		√	×
	Subtotal for Drawings (a *subminimum of 50% (30 out of 60) is required for the drawings in order for the student to obtain a final mark ≥ 50%*)						**60**			
Are the drawings (detail and assembly) of an acceptable engineering standard? **– if the answer is "NO" a mark of less than 50% must be awarded** for the drawings.									√	×
Presentation (Oral communication)										
16	Organization (purposeful, clear)						5		√	×
17	Manner (confident, direct)						5		√	×
18	Body language and value of speech						5		√	×
	Subtotal for Presentation						**15**			
Total for ELO 6 (Final report + 0.25xDrawings + Presentation) (a *subminimum of 50% (50 out of a 100) is required for ELO 6 in order for the student to obtain a final mark ≥ 50%*)							**100**			
Did the student communicate effectively, both orally and in writing within engineering audiences and to the community at large? The communication should be of an appropriate structure, style and graphical support – **if the answer is "NO" a mark of less than 50% must be awarded** for ELO 6.									√	×

Combined: Combined mark of internal and external examiner after oral examination

Total (ELO 3 + ELO 6) (200): _____

FINAL MARK: _____%*

Note: A subminimum of 50% had to be obtained for ELO 3, ELO 6 as well as for the drawings in order to obtain a final mark ≥ 50%

_____ Name: Internal Examiner

_____ Signature: Internal Examiner

_____ Name: External Examiner

_____ Signature: External Examiner

*A final mark between 45-49% implies that the student qualifies for a supplementary exam. In this case the form "Required Rectification for Supplementary Examination" has to be completed during the oral examination.

Appendix C – Drawings for evaluation

This form is available for download on ClickUP.

DESIGN PROJECT - MOX 410

DRAWINGS FOR EVALUATION

Student _____ **Student. no.**_____

Design project _____

The following drawings must be submitted:

- One assembly drawing consisting of at least four different components as agreed upon between study leader and student.
- 2 x detailed CAD drawings of two different component indicating all necessary manufacturing detail to ensure correct functioning and assembly.
- 2 x detailed hand drawings of the other two components each indicating all necessary manufacturing detail to ensure correct functioning and assembly.

Drawings must be submitted on the due date for the deliverables stated in the study guide in the following formats:

- In an appendix as part of the two hardcopies and electronic copy of the final report as specified in section 9.3. Deliverables of the study guide of this module

Drawing	Description
Assembly drawing	
Detail CAD 1	
Detail CAD 2	
Detail Hand 1	
Detail Hand 2	

Date _____

Signatures:

_____ Student

_____ Client

Appendix D - Required Rectification for Supplementary Examination

DESIGN PROJECT - MOX 410

REQUIRED RECTIFICATION FOR SUPPLEMENTARY EXAMINATION

Student: _____ Student. no.:_____

Internal examiner: _____

External examiner:	Contact number:	Email address:

Required rectifications:

NB: Copies of this form should be made and given to the student and the internal examiner.

Date _____

Signatures:

_____ Student

_____ Internal examiner

_____ External examiner

Appendix E – Guideline for final report

The student can use the following as a guideline as to what should be included in the report and how the report should be laid out. The student should please note that this is a guideline of the contents and layout of the final report and some of the mentioned headings may not be applicable to the student's project. The student may also need additional headings to fully communicate his/her work.

i. Cover page

The cover page typically consists of:

- the design project title, as agreed with the lecturer,
- initials, surname and student no. of the author,
- study leader,
- year,
- department.

ii. Abstract

The abstract should briefly address the following:

- What was the problem?
- Why was it done?
- How was it done? (methodology)
- What were the results?
- What are the conclusions and recommendations?

iii. Acknowledgements

It is fitting to acknowledge people who made a direct contribution to the project.

iv. Table of contents

v. List of symbols, abbreviations,

All symbols and unfamiliar abbreviations which are used in the text must be clearly defined and explained in this section. The order in which the symbols are listed is usually:

- English letters and symbols
- Greek symbols
- Superscripts
- Subscripts

SI-units of all symbols must be supplied as part of the definition.

vi. List of figures and tables

vii. Introduction and/or background

viii. Problem statement and objectives

ix. User requirements

x. Literature study

The function of the literature study is to investigate what has already been done with regard to the problem at hand or similar problems. It should be used to get an idea of what techniques exist and how they can be applied, if at all. From the literature study it should be concluded whether there is existing techniques, whether they will be used or not, and why. The literature study should include material that has not formally been taught in the undergraduate curriculum.

xi. Functional analysis

xii. Design requirements / Technical specifications

xiii. Concepts
   a. Concept generation
   b. Concept selection

xiv. Detail design
   a. Calculations
      Make use of sketches for clarity of the parts for which calculations are done. Calculation should be included in the main body of the report. Repetitive calculation and program code should rather be included in an appendix to avoid loss of coherence of the main report. Please note that scanned hand calculation may be included in the report if you are not familiar with the equation editor in the word processor (for example Microsoft Word) that you are using.
   b. Analysis
      If analysis tools are used such as FEM, Multi-body dynamics or CFD software, the results can also be included in the report. The student should however support any analysis with appropriate sanity checks.

xv. Manufacturing analysis
The manufacturing process for two components for which drawings were prepared must be described completely by the student.

xvi. Maintenance analysis

xvii. Cost analysis

xviii. Impact of design (social, legal, health, safety, environment)

xix. References / Bibliography
Please make sure that the correct referencing technique is used. For more information on referencing techniques please see UP's Library website (link provided below).
http://www.library.up.ac.za/referencing/index.htm

xx. Manufacturing drawings
For full details on the drawings that have to be included in the report see section 9.3.2. Manufacturing drawings

xxi. Appendix

The appendix should be used to include information that is not included in the main body of the report in order to avoid loss of coherence.

The appendix should not be used to include catalogues. If catalogues were used during the design the student can simply reference the catalogues using the correct referencing technique (see section on References / Bibliography above)

As standard for this module the following should be included in the appendix:

- Design Project Proposal (with all amendments if applicable)
- Part I of the Progress Report (Executive Summary, Project Plan and Reflection)
- Meeting Log Card (see Appendix A)
- Drawings for Evaluation form (see Appendix C)