كلية الهندسة
College of Engineering
QATAR UNIVERSITY جامعة قطر

Department of Electrical Engineering

Senior Design Project Handbook

Academic Year 2022-23

Bachelor of Science in Electrical Engineering

Department of Electrical Engineering
College of Engineering
Qatar University

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Version 6.0, December 2021

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1. Introduction

Engineering design is a process of devising a system, component, or process to meet desired needs and specifications within constraints. It is an iterative, creative, decision-making process in which the basic sciences, mathematics, and engineering sciences are applied to convert resources into solutions. Engineering design involves identifying opportunities, developing requirements, performing analysis and synthesis, generating multiple solutions, evaluating solutions against requirements, considering risks, and making trade-offs, for the purpose of obtaining a high-quality solution under the given circumstances. For illustrative purposes only, examples of possible constraints include accessibility, aesthetics, codes, constructability, cost, ergonomics, extensibility, functionality, interoperability, legal considerations, maintainability, manufacturability, marketability, policy, regulations, schedule, standards, sustainability, or usability.

The Senior Design Project (SDP) is a demanding and challenging, yet rewarding, part of your degree. The SDP course provides an integrated assessment of the progress of students towards the desired electrical engineering competency. It is, therefore, important to design fair and broad guidelines for better assessment of this course.

The main purpose of the project is to improve the students' technical skills, research skills and communication skills by integrating writing, presentation and teamwork opportunities. The design project is comprehensive. It focuses on professional practice and includes a variety of non-technical issues such as economic factors, safety, reliability, environmental impacts and social impacts. The students are required to follow relevant national and international standards as well as understand and apply the ethical principles.

A list of projects is typically proposed by the Department faculty members and distributed to students to choose from. Through their summer training course or any other relation to entities outside the University, a group of students can also choose the topic of the design project; the selected topic has to meet the requirements of SDP as deemed by the Department and if accepted, a faculty member relevant to the technical area of the student’s proposal will be assigned by the Department, pending availability and willingness of faculty members. To complete the SDP successfully, students are required to demonstrate their ability to: (i) conduct a critical and comparative literature survey, (ii) perform relevant design calculations, (iii) identify multiple realistic design constraints along with the required standards, (iv) propose several alternative solutions, (v) choose an appropriate justifiable solution to the given problem, (vi) perform hardware and/or software implementation of their design and (vii) evaluate the system performance in the context of the identified multiple realistic design constraints and standards.

Externally sponsored projects are welcome as they benefit the industry and guarantee a strong educational experience for our students. Sponsored projects can be tailored to meet the requirements of the Electrical Engineering SDP.

This handbook describes the SDP allocation process, supervision arrangements, assessment requirements and guidelines for writing final reports for all undergraduate senior design projects in the Department of Electrical Engineering.

1.1 Course Objectives

Students must be prepared for engineering practice through the curriculum culminating in a major design experience based on the knowledge and skills required in earlier coursework and incorporating engineering standards and multiple realistic constraints that take into account considerations such as: economic, environmental, safety, manufacturability, ethical, and social aspects. The objectives of this course are:

1. Students can select and plan an engineering project involving analysis and design tasks
2. Students can conduct a critical and comparative literature survey
3. Students can carry out, as a team, electrical engineering design
4. Students can perform the relevant calculations, analysis, and implement their design.
5. Students can understand economic, and environmental issues related to technology.
6. Students can understand the impact of engineering on societal issues.
7. Students can communicate technical information in writing.
8. Students can communicate in oral and critically evaluate technical information

1.2 Course Learning Outcomes

The general course learning outcomes of the Department's SDP are that:

a) Students can conduct a literature survey.
b) Students can design an engineering project, by setting objectives that are appropriate for the project purpose and scope and that take into account the following aspects: public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
c) Students can plan an engineering project involving multiple tasks and work effectively on a team to complete the project.
d) Students can identify, formulate and solve a complex engineering problem*.
e) Students can communicate technical information in writing and oral presentations.
f) Students can demonstrate the ability to acquire new knowledge using appropriate learning strategies (e.g., various online and library resources) and synthesize the acquired information.

1.3 Relationship of Course Learning Outcomes to Student Outcomes (SOs)

Course Learning Outcomes (CLOs)	Related Student Outcomes						
	1	2	3	4	5	6**	7
a				✓			
b	✓	✓		✓		✓	
c					✓		
d	✓						
e			✓				
f							✓

**Complex engineering problems include one or more of the following characteristics: involving wide-ranging or conflicting technical issues, having no obvious solution, addressing problems not encompassed by current standards and codes, involving diverse groups of stakeholders, including many component parts or sub-problems, involving multiple disciplines, or having significant consequences in a range of contexts.*

***Applies to ELEC499 only.*

Student Outcomes (ABET Criteria)

1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3) An ability to communicate effectively with a range of audiences
4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

2. Senior Project Student Eligibility and Allocation Process

An SDP in the Department of Electrical Engineering is a two-semester course in which students form teams, usually of 2-3 members, select a design project based on their interest and are supervised by one or more faculty members. The SDP I course is offered in the **Fall semester, and SDP II** in the following **Spring semester**.

A student is eligible to request registration in the first part of the Senior Design Project (SDP I), which is offered only in Fall semesters, if the student can get a documented plan from the advisor which shows that he/she can graduate within a **maximum of 3 semesters** starting on the Fall semester of the requested SDP I registration (i.e., the Fall semester for registering SDP I, the Spring semester for registering the second part of the Senior Design Project (SDP II), and - if needed - a final Fall semester right after). This cannot include any Summer or Winter plans whether inside or outside Qatar University. The final decision for SDP I registration for any student will always remain pending until receiving the approval from the Department of Electrical Engineering.

During the first semester, which will start in the Fall of an academic year, the students register in phase one of the projects (course code: ELEC 498; three-credit hour). After successful completion of the first part, the students can register in part two of the project (Course code: ELEC 499; three-credit hour). For both parts, the students are expected to discuss their progress with their supervisors in regular weekly meetings. The students submit written reports, logbook, presentations, posters and other supporting material, present and defend their work at the end of each semester.

There are several steps to the SDP allocation process which are summarized as follows:

1. All faculty members will submit the SDP proposal forms (See Appendix I). Students will be given the opportunity to suggest their own project provided it

meets the SDP standard. **Students are not allowed to pre-select/specify the supervisors in their proposed projects**.

2. All SDP proposal forms will be presented to the SDP Committee by the SDP Coordinator for checking/modification and approval.
3. Faculty members whose proposals require modifications will be contacted by the SDP coordinator.
4. All approved SDP proposals will be made available to all students.
5. Students should form groups of 2 to 3 members. In case of multidisciplinary projects (MDSDP), the number of EE students should not exceed 3 students per project per participating EE faculty member.
6. Each student group will provide five project choices from the list of approved proposals in descending preference order (i.e., 1st choice is the most preferred and 5th choice is the least preferred. While choosing the project, students should consider the prerequisite courses listed in the project by the faculty. There are two types of prerequisites individual and group. Individual prerequisites require that each student in the group must meet the prerequisites, whereas for group prerequisites at least one student of the group must meet the prerequisites. If the prerequisites are not met at the time of registration, the students will not be allowed to register for their allocated project. **For students applying for multidisciplinary projects (MDSDP), the MDSDP must be put as first choice and they have to select four other projects from the regular SDP approved list (point 4 above). Once the MDSDP project is approved by the TIEE and students have signed for it, then they cannot withdraw and change the project.**
7. The SDP Coordinator will collect the students' choices and will make an initial allocation based on the following criteria:
    - Student choices
    - Pre-requisites of the proposal
    - Number of required students
    - Faculty Load
8. The SDP Coordinator will present the initial allocation list to the SDP Committee for approval.
9. In case one project is chosen by more than one group, a random selection draw will be applied, and the groups not selected will be moved to their next available choice.
10. Once approved by the SDP Committee, the allocation list will be published and all students will be asked to register with the assigned faculty member(s).

Students can propose their own project, preferably sponsored and/or supported by industry. In this case, they should submit the proposal to the SDP coordinator indicating clear contact information (Name, Email, Phone number) of industry mentor/focal point/co-supervisor. The SDP committee will evaluate the proposal and allocate appropriate supervisor(s) if the proposed project meets the SDP requirements, and an available faculty member is willing to accept. The students will still need to fill the SDP allocation choices form indicating their 5 choices of SDPs proposed by faculty. In case the students' proposed project was not accepted or no faculty was found to supervise it, the students will be allocated to one of their 5 choices as per the regular SDP allocation process.

2.1 Project Timetable

The allocation process of SDPs starts in the Spring semester, and the timeline is given in Table 1. The key activities which make up the SDP work and an indication of deadlines are shown in Tables 2 and 3. All students are expected to manage their own time throughout the project period, to meet all deadlines, and to meet their supervisor(s) regularly.

Table 1: Allocation process (Spring Semester)

Key	Activities	Timetable
1	Submission of SDP proposal forms by faculty members and students*	Week 5
2	Screening of SDP proposals by the SDP Committee (including proposals from students)	Week 9
3	Making all approved SDP proposals available to all students	Week 10
4	Informing students of their allocated title and supervisor	Week 12

* Submission of project proposals by students will require an industry support letter signed.

Table 2: SDP 1 Timetable

Key	Activities	Timetable
1	Submission of interim progress reports	Week 4 (Sun) and 10 (Sun)
2	First draft report submission to the supervisor, internal and external examiners	The week before the last teaching week (Tue)
3	Receiving comments from supervisor(s) and examiners on the First Draft Report	Last teaching week (Tue or Wed or Thu)
4	SDP Presentation	Last teaching week (Tue or Wed or Thu)
5	Final Submission of revised report, logbook	Two weeks after the last teaching week (Tue)

Table 3: SDP 2 Timetable

Key	Activities	Timetable
1	Submission of interim progress reports	Week 4 (Sun) and 10 (Sun)
2	First draft report submission with poster (Soft copy) to the supervisor, internal and external examiners	The week before the last teaching week (Tue)
3	Receiving comments from supervisor(s) and examiners on the First Draft Report	Last teaching week (Tue or Wed or Thu)

4	SDP Presentation	Last teaching week (Tue or Wed or Thu)
5	Semi-Comprehensive Assessment Exam	End of January
6	Final Submission of revised report, poster, and logbook	Two weeks after the last teaching week (Tue)

3. Project Supervisors

Each group of students is allocated one or two supervisors who are faculty members and who are experienced in fields appropriate to the project title. Additionally, the main supervisor acts as a Personal Tutor to each of his or her project students, in-line with Department practice.

The role of the supervisor is to guide the students as appropriate, but the work itself is carried out by the students. It is important for the students to meet with their supervisors regularly in order that progress may be monitored and help and advice may be given. Meeting times should be agreed between the students and the supervisors to happen at least once per week, students may also see their supervisors at other times by mutual arrangement. Students should refer to the SDP coordinator initially if they experience any difficulties with the supervisory arrangements.

External projects (i.e., industry-sponsored project) are co-supervised by a faculty member and an engineer from the host company. The assigned faculty member is responsible for direct communication and coordination with the sponsor company and the external supervisor.

4. Project Work

4.1 Project Logbook

Students are required to maintain a project log which must be in the form of a book such as a laboratory logbook or electronic-based logbooks.

Students should keep a record in this book of all times when they work on their project and what they do. They should take the logbook with them whenever they visit their supervisors so that they can show what they have been doing and be reminded of any problems they may wish to discuss.

Students should also make notes in the logbook of what they plan to achieve before the next meeting together with any information or explanations their supervisors may give to them. The main benefit of keeping a record of the work is that the logbook allows students to use their time in the most effective way, by avoiding the duplication of work and the loss of important ideas or information. They will find it helpful to make a note of any references they use (books, technical journals, papers, etc.). The keeping of logbooks is a standard practice in the industry and will be of invaluable help when writing the project report.

The logbook can be used to record the following important information:

- Minutes of the weekly meetings with the action plan of the tasks. The minute should record the attendee, the time and date of the meeting, action taken during the meeting.

- Calculations, ideas, experiments, drawings, handouts, etc., which may have bearing on developments.
- Entries should also include problems worked on as well as possible solutions plus calculations and tests made.
- Drawings, graphs, handouts, etc.

Finally, when the project is completed, each group should hand-over their own logbook to the supervisor along with the final project report.

4.2 Backing up work

Students are reminded to make regular **back-up** copies of their work to prevent total loss of data and a setback in their project schedule in the event of such mishaps as a hard disc “crash” or theft of a computer. Backing-up of data is particularly important in cases where several persons may share the same computer.

Loss of computer software and data will not be an acceptable justification for incomplete or the untimely completion of project work.

4.3 Project Planning

Students will find it difficult to achieve their aims without prior planning due to the limited resources, limited time and the amount of work involved. It is unlikely that they will be able to keep rigidly to a timetable, but an attempt has to be made to devise a schedule so that the work can be completed in the specified time. It is, therefore, important that they begin with a plan and be clear about what they intend to achieve.

Students may consider the following planning outlines:

- Determination of the objectives.
- Identify multiple realistic design constraints and standards for their chosen design problem
- Identification and listing of the activities to be carried out.
- Estimation of the time needed for each activity to be completed.
- Checking the resources available and draw up a schedule taking into account holidays, time to obtain equipment and other work.
- Re-plan as necessary.

It is important that students identify any components or items of software, which are difficult to obtain, or those with long delivery times, as soon as possible. Students should let the technical staff know if they will be requiring help from them.

4.4 Testing

Students must allow plenty of time for testing and debugging any hardware or software that you design. They should not expect it to work first time! In many cases, more time is required for testing and debugging than for any other activity. Students should make notes and describe in their project report how they overcame the difficulties they faced.

It is often said that testing is only 10% of a project but takes 90% of the time!

4.5 Plagiarism

Plagiarism will not be tolerated and is against the University regulations. The large-scale insertion of material straight from the Internet is not acceptable. Any such material

must be specifically referenced. This includes the flagrant copying of circuit diagrams from sources such as catalogues or any diagram from an online source. When work undertaken by others is incorporated into a project, it must be reworded/redrawn in addition to being referenced accordingly in the report.

A signed statement that the project and report is the students' own work except where specifically referenced must be submitted with the project report. A copy of this statement can be found in Appendix II.

The Department uses plagiarism detection software to scan all project reports, and anyone found guilty of plagiarizing the work of others will be disciplined according to University regulations.

4.6 Academic Support and Learning Resources

The University Student Learning Support Center (SLSC) provides academic support services to male and female students at QU. The SLSC is a supportive environment where students can seek assistance with academic coursework, writing assignments, transitioning to college academic life, and other academic issues. SLSC programs include: Peer Tutoring, the Writing Lab, Writing Workshops, and Academic Success Workshops. Students may also seek confidential academic counselling from the professional staff at the Center.

Contact Information for Students Support and Learning Resources:
Tel: (00974) 4403 3876
Fax: (00974) 4403 3871
Location: Female Student Activities Building
E-mail: learningcenter@qu.edu.qa

4.7 Personal Difficulties

The project makes considerable demands on students' personal ability, initiative, and dedication. Students may experience periods of doubt and uncertainty, particularly if things do not seem to be going well. Keeping in touch with other project students can provide mutual help and encouragement. If a student feels particularly worried (or see fellow students in this state), he/she should seek help from his/her Project Supervisor and/or SDP Coordinator.

Students are reminded that the role of the supervisors is to help and support students. Obviously, such help and support should stop short of actually doing the job for them. Students are also reminded to acknowledge any help received from other people.

4.8 Support for Students with Special Needs

It is Qatar University policy to provide educational opportunities that ensure fair, appropriate and reasonable accommodation to students who have disabilities that may affect their ability to participate in course activities or meet course requirements. Students with disabilities are encouraged to contact their Instructor to ensure that their individual needs are met. The University through its Special Needs Section will exert all efforts to accommodate for individuals' needs.

Contact Information for Special Needs Section:
Tel-Female: (00974) 4403 3843
Tel-Male: (00974) 4403 3854

Location: Student Activities Building
Email: specialneeds@qu.edu.qa

5. Project Work Assessment

For each project part (i.e., ELEC498 and ELEC499), the project work will be assessed towards the end of the semester. ELEC498 will be assessed by the supervisor(s) and two internal examiners, while ELEC499 is assessed by the supervisor(s), an internal and an external examiner. The final project mark is the collective mark of all assessors. Students' abilities to solve complex problems and effectiveness in expressing ideas through their reports and oral presentations are assessed. By considering the scope and depth of the students' consideration of all issues related to the design project, examiners will be able to assess the students' abilities to consider wider environmental issues which often accompany electrical engineering practice.

5.1 Reports Submission

The students are required to submit two interim progress reports by weeks 4 and 10 (Thursday end of day) for both courses (i.e., ELEC 498 and ELEC 499) and a final report one week before the last teaching week (Tuesday). The interim report should be prepared using the final report template focussing on literature survey, multiple realistic design constraints and standards, problem definition, objectives of the design and preliminary design in ELEC 498. The interim reports of ELEC 499 should focus on final design, compliance with the set multiple realistic design constraints, results, and discussions. The interim and final reports should be submitted through BlackBoard (link will be provided by the main supervisor). The interim report will be graded by the supervisor(s), and feedback will be provided to be taken into consideration when preparing the final report.

The final report will be graded by two internal examiners in the case of ELEC 498 and one internal and one external examiner in the case of ELEC 499. Feedback will be provided to the students to improve their report. Final corrected reports will be submitted by the students two weeks after the last teaching week.

5.2 Assessment of ELEC 498

At the end of this course, a first final report should be written in which the problem statement, literature survey, design concepts, design options, multiple realistic design constraints, international and national standards used, simulation work and hardware concepts are clearly described. Students will also be required to prepare an oral presentation. During the project defence, 15 mins will be allocated for presentation and 15 mins for question-answer and 5 mins for deciding on grades. Assessment at this level is based on the senior project proposal submitted at the beginning of the course, the two interim reports, and the progress report submitted in the middle of the semester. Examiners will evaluate and present constructive criticism and suggestions to help improve and develop the project. Table 4 shows the marking scheme for the assessment of ELEC498. Assessment rubrics and grading forms can be found in Appendix III.

Table 4: Marking scheme for ELEC 498

Key	Assessment Element	Assessor	Maximum Mark
1	Student progress	Supervisor(s)	25%
2	Professional Conduct	Supervisor(s)	25%
3	Project Report*	Examiners	30%
4	Presentation and defence	Examiners	20%
5	Logbook	Supervisor(s)	Pass/fail
6	Corrected Final Report	Supervisor(s)	Pass/fail

***The deadline for submitting the project report is one week before the presentation. If students do not submit their report on time, a 25% per day of the report grade will be deducted. If no report is submitted 24 hours before the presentation, a grade F will be given to the whole project.**

Note: Grade "I" will be awarded to the group who do not address multiple realistic design constraints and standards in their report.

The two examiners (internal and external) will provide separate grades in a two separate grading sheets; however, they are expected to discuss the students' performance together before filling their sheets.

Before posting the final grade of ELEC 498, each group of students must submit the following items to the Department in a Flash Drive placed in different folders named as follows:

- **SDPF1. Reports** (this folder should include the first draft report, reports with examiners' comments and final report)
- **SDPF2. Logbook**
- **SDPF3. PPT** (presentation)
- **SDPF4. Source Code** (if applicable – software project files)

5.3 Assessment of ELEC 499

At the end of this course, each group will submit a final report, prepare an oral presentation and demonstrate their final prototype. By reading the report, observing the presentation, and inspecting the realized project, the examiners should be able to assess the written and oral communication skills and the problem-solving skills of the students.

There will be a written exam (comprised of multiple choice questions) to assess the fundamentals of electrical engineering knowledge of graduating students. The exam (semi-comprehensive assessment of the fundamentals of electrical engineering) will be online, and the questions will be asked from core electrical engineering courses based on fundamentals of electrical engineering (**scope: communication, control systems, digital/embedded systems, electric circuits, electronics, machines, power electronics, power systems, sensors and instrumentation, and Ethics**). The exam will serve as an input to the Department on the quality of our graduates. This exam is weighted as 10% of the total grade. Table 5 shows the breakdown of marks for the ELEC499 course. Details about the assessment rubrics and the used grading forms can be found in Appendix IV.

Table 5: Marking scheme for ELEC 499

Key	Assessment Element	Assessor	Maximum Mark
1	Student progress	Supervisor(s)	20%
2	Professional Conduct	Supervisor(s)	20%
3	Project Report*	Examiners	25%
4	Presentation and defence	Examiners	20%
5	Poster	Supervisor(s)	5%
6	Corrected Final Report	Supervisor(s)	pass/fail
7	Logbook	Supervisor(s)	pass/fail
8	Semi-Comprehensive Assessment of Electrical Engineering Fundamentals	-	10%

***The deadline for submitting the project report is one week before the presentation. If students do not submit their report on time, a 25% per day of the report grade will be deducted. If no report is submitted 24 hours before the presentation, a grade F will be given to the whole project.**

Note: Grade "I" will be awarded to the group who do not address multiple realistic design constraints and standards in their report and show the evidence of using those constraints in their design process (compliance with the constraints).

The two examiners (internal and external) The two examiners will provide separate grades in a two separate grading sheets; however, they are expected to discuss the students' performance together before filling their sheets.

Before posting the final grade of ELEC 499, each group of students must submit the following items to the Department on a Flash Drive placed in different folders named as follows:

- **SDPF1. Reports** (this folder should include the first draft report, reports with examiners' comments and the final report)
- **SDPF2. Logbook**
- **SDPF3. PPT** (presentation and poster)
- **SDPF4. Source Code:** (if applicable - software project files)

6. The Project Reports Brief

Students must obtain a copy of the SDP report template file and then use it as the starting point for the creation of your project reports (final and interim progress). Using the template will ensure that the reports comply with the standard of layout required. The template must not be changed in any way. The reports will be marked down for poor presentation if the template is not used. The template can be downloaded from the Department website or the course website on Blackboard.

Interim progress reports are very important to check the progress of students in the course and will be graded by the supervisor(s). The interim reports should be prepared using the final report template.

It is important to emphasize on the design component in the project, show multiple solutions and justification for choosing a particular solution out of several solutions. Multiple realistic design constraints should be included with quantitative values and qualitative descriptions. It is also important to show that the design constraints are used throughout the design process in the report (at the end of the design section or within the design steps) as well as evaluate the compliance of the system to the design constraints. International and/or national standards should be included and discussed, and its impact on the design should be addressed.

The length of the report should not exceed 35 and 50 pages (excluding appendices) for ELEC498 and ELEC499, respectively.

6.1 Writing Style

The report should be written in clear, concise and direct style. There is no reason to make the wording of a report complex. The aim of writing a report is to convey information and ideas to the reader, not to impress them with obscure vocabulary or jargon. Do not use long phrases when shorter ones will do. Use of correct English is essential.

6.2 Report Format

The report must consist of the following items in order:

1. A Title Page
2. Declaration Statement: a signed statement that the project and report are the students' own work except where specifically referenced must be submitted with the project report.
3. Abstract: the abstract is a short summary describing the overarching objective of the work, the summary of the work done and the main findings as described in the report and should not normally be longer than 400 words. The abstract is not intended to replace any other sections of the report, e.g., the introduction.
4. Acknowledgment: this section includes thanks to all the people who have helped.
5. Table of Content: this is a list of every major item in the report, including Chapter headings and sub-sections, each with its page number given.
6. List of Figures
7. List of Tables
8. Glossary of Terms: this section consists of a list of all specialist vocabulary or acronyms with a brief explanation of their meanings.
9. Main body of the report: this part should contain the main chapters of the report. See next section for more details.
10. References
11. Appendices

6.3 Main Body of the Report

Due to the diversity of projects, students should consult their project supervisor(s) about the most appropriate structure for the main body of the report.

The main body of the report should typically contain the following sections:

Introduction: this section should contain a brief statement about the subject and its importance, a justification for dealing with the subject, the aims and objectives of the project and the methods employed to achieve these objectives.

Multiple realistic design constraints and Standards: Once the problem is defined and the objectives of the project are set, multiple realistic design constraints should be identified. Some of the constraints can be qualitative, such as ease of use, social, political, health and safety, ethical, manufacturability, sustainability, reliability, durability, legality, etc. Some of the constraints should be quantitative such as physical dimension, weight, power consumption, system response, cost, efficiency, etc. International/national standards should be identified related to the design. The designed system should also be evaluated in terms of compliance with the constraints and standards.

Literature Review: this should be written as a stand-alone chapter that reviews the history and background plus the present state of knowledge of the subject area of the project work. Any material derived or quoted from published or unpublished work of other persons has to be very clearly referenced or acknowledged. This chapter should also show the reader that students have read, and have a good grasp of, the main published work concerning a subject area of the project work.

Description of the Project Work: what has been achieved throughout the period of the project work should be described here. Students may split this into several chapters if there are several distinct areas.

Results and Discussions: results and measurements that have been generated throughout the project should be presented and discussed in this section. Make the best use of methods for expressing results in a useful and informative manner (e.g., Graphs, charts, diagrams, etc.). The results and discussion section may re-examine the cost aspects and marketability of the project.

Conclusions: this should provide a concise summary of the major findings of the project together with comments and recommendations. The conclusions should be readable on a "stand-alone" basis by someone who has not read the rest of the report yet can understand what has been done. Hence, the conclusion should start with a brief outline of the project work, and then provide a critical outcome of the investigation based on a discussion of all results. References should be made to the objectives set out in the introduction.

Further Development: in this section detail about any further development, improvement and future direction of the current project are discussed. This could be part of the “conclusion” chapter. Discussions of the commercial viability of the project can also be included here.

Other points: in addition to the technical aspect, the report must demonstrate an awareness of time management, costs, and market needs. This part of the report may vary from a project to another. Examples of the type of material which should be included are:

- A time plan that shows timescales for major activities and comments about any modifications made to ensure the smooth running of the project.

- A detailed costing of the development work that has been undertaken during the project.
- A discussion of potential applications for the presented work.

APPENDIX I – proposal forms

SDP Proposal Form

Project Title:			
Area of Specialization of Project:			
Number of Students:		3	
Industrial Partner:			
Industrial Contact [ ] or Co-Supervisor [ ]			
Supervisor: **Co-supervisor (if any):**			
Individual pre-req:		**Group pre-req:**	

Short Project Description

- **Problem statement:**

Discuss the main problem addressed by the project.

- **Objectives:**

List of key objectives that needs to be achieved.

- **Deliverables:**

List of key deliverables from the project.

- **Design aspects:**

Brief list of key specifications, key constraints and standards relevant to the project.

References:

Student SDP Proposal Form

<table>
<tr><td colspan="2">Project Title:</td><td colspan="2"></td></tr>
<tr><td colspan="2">Area of Specialization of Project:</td><td colspan="2"></td></tr>
<tr><td colspan="2" rowspan="3">Names and IDs of Students:</td><td colspan="2">S#1</td></tr>
<tr><td colspan="2">S#2</td></tr>
<tr><td colspan="2">S#3</td></tr>
<tr><td colspan="2">Industrial Partner:</td><td colspan="2"></td></tr>
<tr><td colspan="2">Industrial Contact [ ] or Co-Supervisor [ ]</td><td colspan="2"></td></tr>
<tr><td colspan="2">Supervisor:
Co-supervisor (if any):</td><td colspan="2">TO BE FILLED BY DEPARTMENT</td></tr>
<tr><td>Individual pre-req:</td><td>TO BE FILLED BY DEPARTMENT</td><td>Group pre-req:</td><td>TO BE FILLED BY DEPARTMENT</td></tr>
<tr><td colspan="4">Short Project Description

• <u>Problem statement:</u>
Discuss the main problem addressed by the project.

• <u>Objectives:</u>
List of key objectives that needs to be achieved.

• <u>Deliverables:</u>
List of key deliverables from the project.

• <u>Design aspects:</u>
Brief list of key specifications, key constraints and standards relevant to the project.</td></tr>
<tr><td colspan="4">References:</td></tr>
</table>

APPENDIX II – Plagiarism Statement

We, the undersigned students, confirm that the work submitted in this project report is entirely our own and has not been copied from any other source. Any material that has been used from other sources has been properly cited and acknowledged in the report.

We are fully aware that any copying or improper citation of references/sources used in this report will be considered plagiarism, which is a clear violation of the Code of Ethics of Qatar University.

In addition, we have read and understood the legal consequences of committing any violation of the Qatar University's Code of Ethics.

	Student Name	Student ID	Signature	Date
1				
2				
3				

THIS STATEMENT MUST BE INCLUDED IN YOUR REPORT AS THE FIRST PAGE.

APPENDIX III – ELEC 498 Assessment Forms

Supervisor Evaluation Form

Student Progress (25%)

SO(1): An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	S#1	S#2	S#3
Identify and formulate a complex engineering problem			
Solve a complex engineering problem by applying principles of engineering			
Solve a complex engineering problem by applying principles of science			
Solve a complex engineering problem by applying principles of mathematics			

SO(2): An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	S#1	S#2	S#3
Identify technical specifications of the electrical engineering system to meet the design goals under specific constraints and standards			
Evaluate the design concepts and select the one that best matches the design constraints considering public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors			

SO(7): An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	S#1	S#2	S#3
Demonstrate an ability to acquire new knowledge using appropriate learning strategies (e.g., various online and library resources) and synthesize the acquired information			
Demonstrate the application of acquired knowledge			

Professional Conduct (25%)

SO(3): An ability to communicate effectively with a range of audiences	S#1	S#2	S#3
Communicate effectively in writing			
Demonstrate effective oral communication			

situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	S#1	S#2	S#3
Recognize ethical and professional responsibilities in engineering situations			
Make informed judgments that consider the impact of engineering solutions in global, economic, environmental, and societal contexts.			

leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	S#1	S#2	S#3
Contribute effectively and positively within the team			
Accomplish tasks, and contribute to meeting objectives			

Note: Grade "I" will be awarded to the group who do not address multiple realistic design constraints and standards in their report.

Examiners' Presentation and Report Evaluation Form

Presentation (20%) (each item 0-10)

Presentation	S#1	S#2	S#3
Technical content of the presentation (problem formulation, knowledge about topics, etc.)			
Presentation contains accurate information which is relevant to the overall project			
Slides flow, use of proper presentation tool (graph, table, illustration etc.), easy and clear to understand			
Language content of the presentation (use of proper English language and grammar)			
Length of presentation is within the assigned time limits			

Report (30%) (each item 0-10)

SO(1): An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	S#1	S#2	S#3
Identify and formulate a complex engineering problem			
Solve a complex engineering problem by applying principles of engineering			
Solve a complex engineering problem by applying principles of science			
Solve a complex engineering problem by applying principles of mathematics			

SO(2): An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	S#1	S#2	S#3
Identify technical specifications of the electrical engineering system to meet the design goals under specific constraints and standards			
Evaluate the design concepts and select the one that best matches the design constraints considering public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors			

SO(3): An ability to communicate effectively with a range of audiences	S#1	S#2	S#3
Communicate effectively in writing			

Note: Grade "I" will be awarded to the group who do not address multiple realistic design constraints and standards in their report.

APPENDIX IV – ELEC 499 Assessment Forms

Supervisor Evaluation Form

Student Progress (20%) (each item 0-10)

SO(1): An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	S#1	S#2	S#3
Identify and formulate a complex engineering problem			
Solve a complex engineering problem by applying principles of engineering			
Solve a complex engineering problem by applying principles of science			
Solve a complex engineering problem by applying principles of mathematics			

SO(2): An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	S#1	S#2	S#3
Identify technical specifications of the electrical engineering system to meet the design goals under specific constraints and standards			
Evaluate the design concepts and select the one that best matches the design constraints considering public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors			

SO(7): An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	S#1	S#2	S#3
Demonstrate an ability to acquire new knowledge using appropriate learning strategies (e.g., various online and library resources) and synthesize the acquired information			
Demonstrate the application of acquired knowledge			

SO(6): An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	S#1	S#2	S#3
Develop an experiment to reach an engineering conclusion			
Conduct an engineering experiment			
Analyze and interpret experimental data to draw conclusions			
Identify the limitations of the design and suggest improvements			

Professional Conduct (20%) (each item 0-10)

SO(3): An ability to communicate effectively with a range of audiences	S#1	S#2	S#3
Communicate effectively in writing			
Demonstrate effective oral communication			

SO(4): An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	S#1	S#2	S#3
Recognize ethical and professional responsibilities in engineering situations			
Make informed judgments that consider the impact of engineering solutions in global, economic, environmental, and societal contexts.			

SO(5): An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	S#1	S#2	S#3
Contribute effectively and positively within the team			
Accomplish tasks, and contribute to meeting objectives			

	S#1	S#2	S#3
Exit Exam			
Poster			

Note: Grade "I" will be awarded to the group who do not address multiple realistic design constraints and standards in their report.

Examiners' Presentation and Report Evaluation Form

Presentation and Report (45%) (each item 0-10)

SO(1): An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	S#1	S#2	S#3
Identify and formulate a complex engineering problem			
Solve a complex engineering problem by applying principles of engineering			
Solve a complex engineering problem by applying principles of science			
Solve a complex engineering problem by applying principles of mathematics			

SO(2): An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	S#1	S#2	S#3
Identify technical specifications of the electrical engineering system to meet the design goals under specific constraints and standards			
Evaluate the design concepts and select the one that best matches the design constraints considering public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors			

SO(3): An ability to communicate effectively with a range of audiences	S#1	S#2	S#3
Communicate effectively in writing			

SO(6): An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	S#1	S#2	S#3
Develop an experiment to reach an engineering conclusion			
Conduct an engineering experiment			
Analyze and interpret experimental data to draw conclusions			
Identify the limitations of the design and suggest improvements			

Note: Grade "I" will be awarded to the group who do not address multiple realistic design constraints and standards in their report.