Jazan University

Faculty of Engineering

Department of Industrial Engineering

Senior Design Project Guideline

1443-1444 H

2021-2022 G

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1. Introduction:

Students in Senior Design Project demonstrate what they have learned from different courses that they have studied in the Industrial Engineering Program by applying their skills and knowledge to solve a real world-problem. The purpose of this guideline is to help faculty and students understanding all requirements of the Senior Design Project, including detailed information about project selection, management, and required written documentation, and how to successfully complete the project as partial fulfillment of the requirement for the degree of Bachelor of Science in Industrial Engineering. Also, the guideline provides student with instructions and outlines of the course evaluation criteria.

The Senior Design Project is composed of two courses, Senior Design Project I (IE 498) and Senior Design Project II (IE 499), which are a design base courses course. IE 498 is a one credit hour course and IE 499 is a three-credit hour course. Senior students who are expected to graduate by the end of the academic year must take the senior design project course as part of the fulfillment of the graduation requirements. Students take IE 498 in the first semester of the senior level year and IE 499 in the second semester.

The Accreditation Board for Engineering and Technology (ABET) states its criteria for design as follows:

A. ” Engineering design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and engineering sciences are applied to convert resources optimally to meet a stated objective. Among the fundamental elements of the design process are the establishment of objectives and criteria, synthesis, analysis, construction, testing, and evaluation. The engineering design component of a curriculum must include at least some of the following features: development and use of design methodology, formulation of design problem statements and specifications, consideration of alternative solutions, feasibility considerations, and detailed system descriptions. Further, it is essential to include a variety of realistic constraints such as economic factors, safety, reliability, aesthetics, ethics, and social impact.

B. Courses that contain engineering design normally are taught at the upper-division level of the engineering program. Some portion of this requirement must be satisfied by at least one course which is primarily design, preferably at the senior level, and draws upon previous coursework in the relevant discipline."

[58th Annual Report, Accreditation Board for Engineering and Technology, page 107]

2. Senior Design Project Objectives

The objectives of the Senior Design Project are:

1. To use and apply the knowledge of mathematics, science, and engineering.
2. Capability of designing a system, components, or processes to meet desired needs within realistic constraints.
3. Understanding of professional and ethical responsibility.
4. Capability of dealing with the techniques, skills, and modern engineering tools necessary for engineering practice.
5. Capability of designing, developing, implementing, and improving integrated systems that include people, materials, information, equipment.

3. Project Selection

Industrial Engineering Faculty members submit a Senior Design Project proposal at the beginning of each semester. Proposals are reviewed by the department Senior Design Projects Committee to make sure that all proposals satisfy the minimum requirements of the Senior Design Project. The Senior Design Projects Committee will provide the faculty member with feedback and then will approve the proposal to be included for the next semester's Senior Design Project list, so students in their Junior year can select their senior design project from the list.

On the other, Students who have an idea and are willing to work on them for their Senior Design Project can submit a preliminary proposal to the Senior Design Projects Committee. The committee will review and evaluate the proposal then will match it with a faculty member interests.

Students enroll in the Senior Design Project as group of at least two students and no more than four students, exceptions must get approved by the Senior Design Projects Committee. A faculty advisor will be assigned to each Senior Design Project to advise and

guide the students throughout the project period.

4. Registration of the Senior Design Project

Students are advised to register for the senior project with a faculty member whose specialty and interests are compatible with the students' preferences. To register for the Senior Design Project, student(s)/faculty should go through the following steps:

1. Expected senior student must sign their name in the Senior Design Project Registration Form (Appendix 1).
2. Faculty advisor submit the Senior Design Project Proposal (Appendix 2).
3. Proposals are presented to the students by the Senior Project Coordinator for selection process.
4. Students may select one of the projects (Appendix 3).
5. Register the students with the selected faculty member.

5. Project Requirement

The Senior Design Projects must be a design-based projects where the following must be considered:

1. Engineering Standards
    a. Engineering Ethics (Appendix 4)
2. Feasibility
3. Design Specification
4. Users and Stakeholders requirements
5. Design Constraints
    a. Economic
    b. Environmental
    c. Manufacturability
    d. Sustainability
    e. Time
    f. Health and Safety
6. Developing alternative Solutions
7. Alternative Selection Criteria
8. Optimal Solution

Faculty advisors are required to submit the Senior Design Projects Requirements Checklist to the Senior Design Projects Committee for review to ensure that all Senior Design Projects meet ABET definition of Engineering Design. Appendices 5, and 6 show the Senior Design Projects Requirements Checklist and an example of how to fill the checklist respectively.

Faculty members at the Industrial Engineering Department do their best to ensure the variety of the Senior Design Projects options that offered to the students each semester. The IE department mainly focus on the following area for the Senior Design Projects:

a) Manufacturing Engineering Systems.
b) Industrial Operations Systems Engineering and Logistics.
c) Human Factors Engineering and Safety.
d) Quality and Maintenance Systems Engineering.

6. Senior Design Project Outcomes (ABET Criteria)

- An ability to identify, formulates, and solves complex engineering problems by applying principles of engineering, science, and mathematics.
- 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.
- An ability to communicate effectively with a range of audiences.
- 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.
- 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.
- An ability to develop and conduct appropriate experimentation analyzes and interprets data and use engineering judgment to draw conclusions.
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

In order to ensure that all senior design project meet ABET outcomes, all advisors are required to submit Appendix 7 to the Senior Design Projects Committee.

7. Documentation

a) Weekly Progress Report

Students in the Senior Design Project meet with their advisor in a weekly base and they are required to meet every week to ensure the progressing of their project. Students document their weekly meeting agenda and the required tasks on the weekly progress report, this will help students to be organized and to keep tracking their activities. The weekly progress report will be submitted to the faculty advisor for evaluation purposes.

b) Final Report

Students are required to submit two final written reports before the end of the first semester for IE 498 and before the end of the second semester for IE 499. The final report for IE 498 must include the following sections and sub-sections:

1. Title Page
2. Introduction
    - Abstract
    - Purpose/benefit
    - Objectives
3. Technical Issues
    - Feasibility
    - Design Challenge
    - Analysis/Experimental Work
    - Literature Review
    - Alternatives
4. Resources
    - Materials
    - Facilities
    - Personnel
5. Economic Factors
    - Budget
    - Funding
6. Project Management
    - Scheduling

- Responsibility

7. Appendices
    - Gantt Chart
    - Specifications
    - Drawings and/or Schematics
    - References and Bibliography

The final written report for IE 499 must include the following:

1. Title page
2. Abstract
3. Table of Contents Acknowledgments
4. Introduction
    - Description
    - Literature Review
    - Solution
5. Design Process
6. Implementation
    - Construction
    - Operation
7. Schedule
8. Budget
9. Conclusions
10. Recommendations for Future Work
11. References
12. Bibliography
13. Appendices

14. Evaluation of the senior design project

The senior design project is evaluated by the advisor and the evaluation committee, the evaluation committee consist of at least two faculty members in addition to the project advisor. The advisor evaluation is based on different parameters include student attendance, discussion ability, progress report and presentation according to Form 4 in Appendix 8. Where, the evaluation committee' assessment involves both the written report and the oral presentation according to Form 5 in Appendix 9.

The written report evaluation takes into account the overall organization and presentation of the report, language (grammar and spelling), the technical contents (Abstract, introduction, problem definition, design realistic constraints (such as technical, economic, safety, ethical, social…etc.). See the layout of the final report in Appendix 10.

The oral presentation evaluation is based on the clarity of purpose, problem identification, solution approach and level, presentation skills, discussion, demonstration of design functionalities.

References

1. Senior Design Guidelines, College of Engineering and applied science, Western Michigan University, https://wmich.edu/engineer/researchcenters/foci.
2. Senior Design Guidelines, Industrial & Systems Engineering, University of Washington, https://ise.washington.edu/students/BSIE/senior-design.
3. Senior Design Guidelines, Faculty of Engineering, KAU University, https://www.kau.edu.sa/Files/829/Files/156389_EE_file.pdf
4. Code of ethics, Institute of Industrial and Systems Engineers, https://www.iise.org/details.aspx?id=299
5. Code of ethics, Saudi Council of Engineers, http://www.saudieng.sa/English/Pages/default.aspx

Appendices

Appendix 1

Form 1: Senior Design Project Registration Form

Senior Design Project

Project Title:		**Date:**
Student Name:		**Student ID:**

I have read and understood all the First Day Materials for the Course. *In particular, this includes*:

1. I am responsible for applying engineering code of ethics.
2. I am responsible for keeping up to date with announcements that I will receive from the course coordinator, academic advisor.
3. I am responsible for submitting tasks on or before the due date.
4. If I am caught cheating, I know that:

    a) The consequences will be set by the Faculty of Engineering Policy on cheating,

    b) The sanctions for cheating could be as high as expulsion with a grade of Ex, failure for cheating, recorded in my transcript, and

    c) Cheating includes *but is not limited* to:

    i) Leaking any confidential information

    ii) Submitting work that is not my own or, for teamwork, not my team's.

    iii) Accepting unauthorized help from other students ***or*** providing unauthorized help to other students (for example, giving another team a copy of your team's work);

    iv) Using unauthorized materials; and

    v) Accepting a grade or other credit for team work to which I have not made an appropriate contribution.

    Signature

    Signature: ----------

Appendix 2

Form 2: Senior Project Proposal Form

Senior Design Project

COLLEGE OF ENGINEERING

Department of Industrial Engineering

IE 498– Senior Project (I) - (Capstone Design)

Proposal Format

Academic year	
Semesters	
Academic Level	**Nine / Ten**
Project Title (Tentative)	
Supervisor	
Number of Student Team	

(IE 498-1, Senior design project (I) Level: 9,)

Task No.	**Task Name**	**Duration (Weeks)**
1		
2		
3		
4		
5		

(IE 499-1, Senior design project (II) Level: 10,)

Task No.	Task Name	Duration (Weeks)
1		
2		
3		
4		
5		

8- Budget & Expenditures Sheet

Items	Description	Estimated Price
1		
2		
3		

9- Visibility of the product and market needs (ABET)

Supervisor	
Name	**Signature**

Appendix 3

Senior Design Project

Form 3: Selection Form

This form has to be completed by a group of students for forming a team for the senior design project. Groups of students will be assigned to projects basis of the group choices and student's GPA.

Student Name: Student ID: GPA:

Wishes order	supervisor	Project title

Appendix 4

Code of Ethics for Engineers

IISE ENGINEERING CODE OF ETHICS

IISE endorses the Canon of Ethics provided by the Accreditation Board for Engineering and Technology.

The Fundamental Principles

Engineers uphold and advance the integrity, honor and dignity of the engineering profession by:

1. Using their knowledge and skill for the enhancement of human welfare.

2. Being honest and impartial, and serving with fidelity the public, their employers and clients.

3. Striving to increase the competence and prestige of the engineering profession; and

4. Supporting the professional and technical societies of their disciplines.

The Fundamental Canons

1. Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties.

2. Engineers shall perform services only in the areas of their competence.

3. Engineers shall issue public statements only in an objective and truthful manner.

4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees and shall avoid conflicts of interest.

5. Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.

6. Engineers shall associate only with reputable persons or organizations.

7. Engineers shall continue their professional development throughout their careers and shall provide opportunities for the professional development of those engineers under their supervision.

Saudi Council of Engineers (SCE)

Code of ethics

Preface

The engineering profession and the services provided by engineers depends significantly on the progress of civilization and the protection and harnessing of natural resources to serve the community and increase the standard of living. Thus, it becomes necessary for engineers to provide their professional services according to ethical standards and rules observing honesty, truthfulness and perfection.

Since the Saudi Council of Engineers is concerned with and aims to promote the profession of engineering and all that would develop and raise the level of the profession and its practitioners under its law promulgated by the Royal Decree No. 36 on 26/09/1423H, and since its vision is to "sophisticate the profession of engineering and enable engineers and institutions of engineering to reach optimal solutions, to improve performance level, and to encourage creativity and innovation to achieve a prestigious international position," the Council has opined to present these rules to engineers and technicians in various positions to serve as professional rules determining proper professional dealing among themselves and with others to serve society.

Since justice, integrity, honesty, truthfulness, keeping one's word, never exposing secrets, mutual advice, mastery of work, and getting away from hurting others are in their entirety the morals and values advocated by Islam that urges to stick to them and to abide by applying them in everyday life, the Saudi Council of Engineers has taken into account these foundations, principles and values when preparing the rules and ethics governing the practice of the profession. Thus, all engineers should abide by these rules in all their professional practices in accordance with the Engineer Agreement signed in this regard. May Allah grant us all success to all that is good.

Rules and ethics of the practice of the engineering profession

General rules:

Rule One: Every engineer should build her/his professional reputation based on efficiency and
proficiency of her/his services, and away from unfair competition with others.

Rule Two: Every engineer should seek to develop her/his personal abilities and efficiency, and
should also provide professional development opportunities for engineers and technicians working under his supervision.

Rule Three: Every engineer should be committed to promoting the fundamental values and principles of the ethics of the engineering profession and should plant them within society. Regarding her/his conduct, every engineer should be s in ways that support and enhance the prestige and dignity of the profession and the secretariat of the locally and globally.

Rule Four: Regarding professional issues, every engineer shall act as a careful agent to the employer, and shall avoid any conflict of interests.

Rule Five: When submitting her/his ideas, views and decisions, every engineer should be keen
to be objective and honest and confined to her/his field of expertise and professional experience.

Rule Six: When providing professional services, every engineer seeks to apply the highest standards of safety and environmental protection in order to achieve the public interest of individuals and society.

Rule One:

Every engineer should build her/his professional reputation based on efficiency and proficiency
of her/his services, and away from unfair competition with others.

1-1 It is obligatory on every engineer not to directly or indirectly pay or offer commissions, gifts or rewards for getting a job with the aim of influence its accreditation. In addition, it is obligatory on every engineer not to make concessions irrelevant to the profession that may be
used to influence the other competitors.

1-2 It is obligatory on every engineer not to compete with any other engineer in contradiction with the regulatory rules in order to replace the latter in a particular job, whether after knowing

that specific steps have been taken towards her/his appointment or after s/he has already been appointed.

1-3 It is obligatory on every engineer not to criticize the reputation or performance of other engineers inappropriately, whether through criticizing and mutilation directly or indirectly.

1-4 It is obligatory on every engineer neither to overestimate the degree of her/his responsibilities in previous work, to be dishonest in the presentation of her/his professional and academic qualifications and past achievements, whether regarding her/him or her/his workers, nor to be dishonest in the presentation of the facts concerning employers, colleagues or partners.

1-5 Every engineer shall review professional service contracts on the basis of competence, professional qualifications and experience, and volume and scope of work, taking into account the equity of appropriate compensations to other professionals and keening on enhancing trust between all contracting parties.

1-6 Every engineer shall take into account the public interest in estimating the engineering services' cost.

1-7 Every engineer shall not undertake or agree to perform any engineering service for free in a way that may affect the professional level of the service provided.

1-8 No engineer shall unobjectively declare the engineering services as a means of propaganda.

In addition, no engineer shall allow the use of her/his name in commercials by manufacturers, contractors and suppliers, unless the engineer has a real role in the advertisement.

Rule Two:

Every engineer shall continue the professional development by developing her/his personal efficiency and abilities, and shall provide professional development opportunities for engineers and technicians who work under his supervision.

2-1 An engineer shall work on developing his abilities in order to raise his professional level by every appropriate means, such as attending professional events, submitting specialized

studies and researches, participating in meetings and activities of international professional bodies, and encouraging and urging his staff of engineers and technicians to do the same.
2-2 Every engineer shall give proper credit for engineering works to those to whom credit is due, and shall recognize the proprietary rights of others. Every engineer shall name the person(s) responsible for designs, inventions or accomplishments wherever possible.
2-3 Every engineer shall be fair in assigning works and tasks to other engineers, in proportion

to the level of their expertise and training.
2-4 Every engineer shall provide all information regarding working conditions to engineers nominated for employment and inform them of all matters relating to the proposed position. After hiring, he shall inform them of all changes that may happen and the commitment to the
principle of estimating lucrative compensations, salaries and allowances for workers in the engineering field.

Rule Three:

Every engineer shall commit to promote the fundamental values and principles of the ethics of
the engineering profession and establish them in the society. In his behavior, he shall adhere to the techniques that support and promote the prestige, dignity and integrity of the profession
locally and globally.
3-1 Every engineer shall commit to apply rules and ethics of the profession in all her/his professional practices, and participate in educational, training and professional activities in institutes, universities and business and professional institutions, in order to promote and establish professional concepts and raise the engineering awareness in society.
3-2 Every engineer shall assume his professional responsibility based on the rules respected by
members of the community, and not contribute to any products that may be easy to use for unethical or banned purposes or result in immediate or long-term risks.
3-3 Every engineer shall refer to the Saudi Council of Engineers in case of disputes related to
the ethics of the practice of the profession. In all cases, the priorities shall be determined according to the following order:
Government regulations and judicial decisions shall have the priority over professional

regulations and laws.

Professional regulations and laws shall have the priority over contracts and individual interests.

3-4 Every engineer shall not participate in or allow the use of his name or the names of his partners on business by a person or an entity which he believes that it involved in a business or

a professional practice based on fraud and cheating.

3-5 Every engineer shall not use the relationship, solidarity or participation with others as a means of covering up behaviors that are inappropriate to the profession.

Rule Four:

Regarding professional issues, every engineer shall act as a careful agent to the employer, and shall avoid any conflict of interests.

4-1 Every engineer shall dedicate their technical knowledge and experience to the benefit of their employers/clients. Every engineer shall assume the responsibilities for their professional

practices, and admit mistakes as it occurred, they shall avoid twisting or warping facts to justify wrong decisions.

4.2 Every engineer shall maintain the confidentiality of the information received by the same in the framework of the duties entrusted thereto and shall not disclose such information only after obtaining an approval to do so; with exception of the cases permitted by the regulations in force and appear to be in line with the applicable principles and code of ethics. Moreover, every engineer shall not use such information as a means to obtain personal gain only after obtaining the approval of the Employer. In any case it shall not be permissible to use such information if such use conflicts with the interests of the Employer or the society.

4-3 Every engineer shall deal with all parties with the utmost integrity and fairness whenever

administrating any contracts or recruiting any personnel. Every engineer shall enter into an agreement before working for those parties to the extent that allows the same to make improvements, designs, innovations and other facilities that require keeping the rights thereof

in writing or innovation, without resorting to deception as a means to induce others to work therewith.

4-4 Every engineer shall not perform any professional service for the account of any party outside of regular work hours only after informing the Employer of the same. Furthermore,

every Engineer shall not use any equipment, materials, laboratories or office facilities pertaining to the Employer for personal purposes without obtaining the approval of the Employer on the same.

4-5 Every engineer shall not inspect the work of another engineer without informing the same

or after the expiration of the contract relevant to such work, unless it is required by virtue of the nature of the job thereof.

4-6 Every engineer, working in the field of sales and manufacturing, is entitled to make comparisons between the products thereof and the products of other suppliers; taking into account not to offer or provide any engineering consultancy, designs or advice except as specifically related to the equipment, materials or systems sold thereby or displayed for sale.

4-7 Every engineer shall avoid any conflict with the Employer's interests and shall notify the Employer immediately after being aware of the existence of any relations, business interests or

circumstances that may affect the decisions thereof or the quality of the services provided thereby. Moreover, every Engineer shall avoid performing any work appears to be in conflict with Employer's interests.

4-8 Every engineer shall not accept any remuneration paid by a party for the services provided

thereby in the same project or in exchange for any services relating to the same work unless it

is expressly agreed in advance between all concerned parties. Moreover, every engineer shall not request nor accept any rewards, whether in cash or in kind, including any free engineering designs provided by the suppliers of materials, further to any equipment, devices or systems used in the description or identification of the products of those suppliers in the work carried out by this engineer. Furthermore, every engineer shall not, directly or indirectly, request nor accept any gifts given by any party dealing with the Employer or relevant to the work entrusted

to the same.

Rule Five:

When submitting the ideas, views and decisions thereof, every engineer should ensure that such

ideas, views and decisions are objective, authentic and fall within the area of specialization and

professional experience of the same.

5-1 Every engineer shall be objective, honest and independent in making any engineering decisions that exclusively fall within the field of the scientific and practical qualification; to the extent that such decisions are only made in accordance with scientific and professional considerations. Every engineer shall benefit from all available specialized expertise and ask the assistance of his colleagues in accomplishing any work falling outside the field of the engineer's specialization.

5.2 When the engineer appears before courts or official commissions as an expert or witness to provide a technical testimony, the engineer shall show the engineering standpoint of the same based on the experience, expertise and knowledge of facts bearing in mind the utmost integrity,

honesty and honor of the profession.

5.3 Every engineer shall not issue any reports, statements or comments about engineering issues if such reports, statements or comments are issued for the purposes of serving the interests of any party or parties unless a prior explicit statement identifying those parties acting on their own behalf is issued.

5.4 Every engineer shall be modest and moderate, while presenting his works and efficiency. Furthermore, the engineer shall avoid committing any act tending to promote his own interest at the expense of the profession's honesty, status and dignity.

5.5 In case of any conflict arising between the values and principles, and the professional services, engineers shall set their priorities as follows:

- Giving priority to human values over the nature's considerations.
- Giving priority to issues related to human rights over production and exploitation of technology.
- Giving priority to the society's general welfare over private interests.
- Giving priority to safety and security over functionality and material gains of technical solutions.

Rule Six:

When providing professional services, every engineer seeks to apply the highest standards of
safety and environmental protection in order to achieve the public interest of individuals and society.

6.1 Every engineer shall comply with the approved standards of public safety and environmental protection, while preparing designs and schemes or upon approval and endorsement. The engineer shall also verify of such compliance, while making decisions and judgments, besides all relevant engineering practices. If the engineer has to provide engineering
solutions that appear to cause threatening to public safety, health of environment or interest of
society, the employer shall, in such case, be informed of all possible consequences.

6.2 Every engineer shall, as much as possible, provide brochures, including examining standards systems and quality control procedures, to the extent that allows the public to understand the degree of safety and security or the life span of designs, products and systems that he was responsible for.

6.3 Every engineer shall exert all efforts for the purpose of providing constructive services to
the nation, in line with the applicable standards and values, promoting the society's interest and
welfare, and complying with providing safety measures in all provided professional services.

6.4 When observing circumstances or conditions posing a threat to public safety, health of environment or interest of the society, the engineer shall notify the concerned entity of the available information, provide the required assistance and undertake the proper check to ensure
safety and reliability of products or systems.

Appendix 5

Requirements Checklist for Senior Design Project I

Requirements for Senior Design Project		
Ensure Components	**Task/Description**	**Short Explanation**
Classification of design of an engineering product		
Meet a desired need		
Use of engineering standards		
Enough realistic constraints		
Development and evaluation of alternative solutions		
Implementation strategy		
Utilization of IE Curriculum		
A physical product or prototype will be built by the end of the project		

Appendix 6

Example of the Requirements Checklist for Senior Design Project I

Requirements for Senior Design Project		
Ensure Components	**Task/Description**	**Short Explanation**
Classification of design of an engineering product	System/Component/Process	Component
Meet a desired need		p.7
Use of engineering standards	Provide a list of standards (IISE, OSHA, ISO…etc.)	SASO p.45 OSHA ISO p.39
Enough realistic constraints	Economic, Safety, Ethics, Social impact..., etc.	p.18 Economic and Social impact
Development and evaluation of alternative solutions	Number of proposed solutions	p.19-23
Implementation strategy	Case Studies/ Lab experiments/ Other.	Modeling, simulation
Utilization of IE Curriculum	IE 438, IE 211, IE 414, IE 323…, etc.	IE 251-3, IE 313-2, IE 454-3, IE 438-2, IE335-2, IE439-2, IE334-2
A physical product or prototype will be built by the end of the project	Yes/No	yes

Appendix 7

Checklist for the Final Senior Design Project Report II

Item	Implemented		
	Yes	**No**	**Indicate page(s) in the report for Yes Cite reason(s) for No**
Problem definition (needs, objectives)	**Yes**		
Use of Engineering Standards	**Yes**		
Several various constraints	**Yes**		
Alternative solutions	**Yes**		
Impact of engineering solutions	**Yes**		
Utilization of IE Curriculum	**Yes**		
Final System/Component/Process	**Yes**		

Appendix 8

Example of the Requirements Checklist for the Final Senior Design Project Report II

Item	Implemented		
	Yes	**No**	**Indicate page(s) in the report for Yes Cite reason(s) for No**
Problem definition (needs, objectives)	**Yes**		page7 1.2 Purpose of the study
Use of Engineering Standards	**Yes**		p.45- 46 / p.39
Several various constraints	**Yes**		p.18 Economic and Social impact p.24 Market Needs p.28 Idea generation p.39, p.45- 46 Engineering standards p.47 Safety impact "raising the safety of gas stations"
Alternative solutions	**Yes**		p.19-23
Impact of engineering solutions	**Yes**		p.24 – 28/ p.39
Utilization of IE Curriculum	**Yes**		IE 251-3, IE 313-2, IE 454-3, IE 438-2, IE335-2, IE439-2, IE334-2
Final System/Component/Process	**Yes**		Component

Appendix 9

Form 4: Advisor Evaluation Form

Senior Design Project

Industrial Engineering Department

Graduation Project Assessment Form for Advisors (100 points)

Academic Year 14--/14-- H – (20--) First Semester

Project Title:

Student ID	Student Name	Measure Scale				
		Attendance	**Discussion ability**	**Progress Report**	**presentation**	**Total**
		20	**30**	**25**	**25**	**100**

Appendix 10

Form 5: Evaluation Committee Form

Senior Design Project

Evaluation of Senior Project

Project Title: **Date:**

Student ID	**Student Name**	Designs and Outputs	Presentation and Oral Exam	Final Report and Poster	**Total**
		40%	**30%**	**30%**	**100%**

Graduation Project Evaluation using Rubric Assessment

(First Seminar/Final Seminar)

Title of the Project:

Name of the Advisor:

S. No.	Student Name	University ID
1		
2		
3		
4		

Outcome	
SO1	**An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.**
PI-1.1	Combines mathematical and/or scientific principles to formulate models of physical processes and systems relevant to engineering.
PI-1.2	Shows appropriate engineering interpretation of mathematical and scientific terms.
PI-1.4	Translates academic theory into engineering applications and accepts limitations of mathematical models of physical reality.
SO2	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.
PI-2.1	**The problem to be solved is clearly stated. Objectives are complete, specific, and concise. Customer needs are correctly identified and transformed into design requirements. All applicable realistic constraints are identified.**
PI-2.3	Develop and compares alternative solutions and selects a baseline design.
PI-2.4	Developed specifications include economic, safety, environmental and other realistic constraints.
SO3	**An ability to communicate effectively with a range of audiences.**
PI-3.1	Present ideas in an organized and logically flowing manner.
PI-3.4	Communicate in correct language free of grammatical mistakes.
PI-3.5	Respond to audience's questions with clear answers.
PI-3.7	Use of Computer presentation software for presenting the project (PPT, or other tools).
SO4	**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.**
PI-4.1	Respect deadlines and be punctual.

PI-4.2	Assume personal responsibility for own actions and decisions.
SO5	**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.**
PI-5.1	Routinely present at team meetings or work sessions. Contributes a fair share to the project workload.
PI-5.3	Shares information with others and provides assistance to others.
SO6	**An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.**
PI-6.1	Identifying clear objectives for the experiment.
PI-6.2	Choosing appropriate experimental test bed (Hardware, Software, or Simulation) to achieve the identified objectives of the experiment
PI-6.4	Ability to analyze and interpret the data.
SO7	**An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.**
PI-7.1	Identify missing information.
PI-7.3	Use accessed information appropriately.

Appendix 11

Senior Project Report Writing Guidelines

The format of the final report is detailed below. The report will be reviewed by the advisor and the evaluation committee; thus, it should be organized and clear.

1. Title Page: include project title, Students names, Advisor, Date

2. Abstract. The abstract should contain a very short description of the report.

3. Introduction. The introduction should be approximately two to three pages in length, and should contain the following information:

• Problem Statement: State the problem to be solved.

• Background or Related Work: State who else has worked on this problem or similar problems

• Solution Statement: State your solution to the problem.

4. Literature Search. Start with your library then search of all relevant online.

5. Solution. This should be a conceptual description defining the solution to the problem.

6. Implementation and Results evaluation. This section describes your implementation and analyzed the experimental results.

7. Conclusions:

1. Summarize what you did. This can be viewed as the evidence.
2. State what you learned (the actual conclusions that you a drawing).
3. List the advantages and disadvantages of your work.
4. State future work and directions, and then list any open problems.

8. Acknowledgements. Acknowledge any individuals who have helped you during the course of the project.

9. References.

10. Appendices. Include brief code, and illustrations of results.