



KING SAUD UNIVERSITY
COLLEGE OF ENGINEERING
DEPT OF CHEMICAL ENGINEERING

Graduation Project Guidelines

2014-2015

SCOPE

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1- ABET CRITERIA

ABET Definition of Engineering Design

- Process of devising a system or process to meet desired needs. It is a decision-making process, in which the basic sciences, mathematics, and engineering sciences are applied to **convert resources optimally to meet a stated objective**.
- Fundamental elements: Establishment of **objectives and criteria, synthesis, analysis, construction, testing, and evaluation**.
- Engineering design includes development of creativity, use of open-ended problems, use of modern design theory and methodology, formulation of design problem statements and specifications, and consideration of alternative solutions.
- Include a variety of **realistic constraints** such as economic factors, health and safety, HAZOP studies, and environment considerations.
- All design work should not be done in isolation by individual students; **team efforts** are encouraged where appropriate.

2- INTRODUCTION

The College of Engineering considers the Senior Design Project as the most important challenge of the Senior Year. The project focuses on the application of the basic science, mathematics, engineering, and design skills taught in earlier courses and labs to a real-life application of product design or process improvement. Throughout the process of completing the project, students work in teams and are guided at various stages of the design project where advisors serve as mentors, consultants, and evaluators. The college goal is to improve the quality of the project leading to internal and external recognition and, ultimately, higher employment rates.

Project Deliverables:

- Progress and Final Reports
- Final Oral Presentations on the Project
- A working model design and/or prototype (software, hardware, or both)
- A poster presentation
- Final (Project Binder)

3- DESIGN PROJECT ESSENTIALS

- The project must be a design project (Capstone design project).
- The project can either be proposed by advisors, a group of students, or an industry/sponsor.
- The project must satisfy the ABET requirements.
- The project should expose the students to real life and open- ended problems and encourage them to find their solutions.
- Project must be related to a known process with an available flow sheet.
- Each project should be undertaken by a group of 2-6 students.
- Each project should be supervised by a group of 2-3 faculty members.
- The tasks of each student must be well-defined at the beginning of the project.
- The project duration is two consecutive semester of 14 weeks each.
- A copy of the proposal must be attached in the final report.

4- RESPONSIBILITIES

Student Duties:

- Students must meet and consult with their supervisors periodically.
- Perform the work assigned and put significant individual effort towards the completion of the group task.
- Maintaining honesty and personal conduct when searching for and obtaining relevant information.
- Submitting all reports on time as specified by project supervisors.
- Attend weekly meeting scheduled by the common advisor.
- Appear for oral examination at the end of the term.

Advisor's Duties:

- Regularly meet with the students and provide assistance.
- Approve the schedule of the different project tasks.
- Control and monitor the progress of the project.
- Assess students both collectively as well as individually.
- Ensure that the team keeps the project binder up-to-date.

- Correct and evaluate the final report.
- Approve the submission of the final project report.

5- DESIGN PROJECT REQUIREMENTS

- The project must include detailed material and energy balance and related design calculations.
- Each student of the group must carry out a full design of a least one major equipment.
- The equipment, not the designed one, must be sized.
- The design must be carried out using hand calculations with detailed explanation and proper justification of underlying assumptions.
- Software packages can be used to support hand calculation.
- A rigorous economical analysis must be made.
- Safety and environmental issues must be clearly addressed.
- Carry out HAZOP study at least for 3 study nodes, in which the nodes must connect to 1 major equipment. An appropriate HAZOP worksheet and report must be produced.
- The control loop for each major unit must be designed and included in the form of block diagram. A P&ID diagram for the entire flow sheet must be included.
- A comprehensive written final report.
- A poster presentation must be made and submitted by the end of the term.

6- ASSESSMENT

Supervisor assessment (40 marks)

- Final project report submission approval.
- Design performance: Identify design parameters and assumptions, design, and sizing of major equipment.
- Cost analysis: Performing cost and profitability analysis of the plant.
- Safety and environmental issues: To deal with safety issues and environmental hazards in the process and the plant.
- Written communications and performance.
- Attendance-Report-References.

Examiners assessment (50 marks)

- Design performance: Identify design parameters and assumptions, design, and sizing of major equipment.
- Cost analysis, safety and environmental issues: Cost and profitability analysis of the plant safety issues and environmental hazards in the process and the plant.
- Written communication skills: Report styles, contents, references, language.
- Oral communications: Delivery slides, questions.

Common Advisor assessment (10 marks)

- Attendance of weekly meeting.
- Submission of weekly progress sheet.

The Oral Presentation

- Each team member will prepare a 10-15 minute presentation to the Graduation Project Examination Committee, in 45-60 minutes time-blocks.
- Presentation should highlight the project outcomes while respecting the allocated time for presentation.
- All team members must make a presentation that will be followed by a question-and-answer session.
- It is strongly recommended that each team rehearse his/her presentation at least once in the presence of their faculty advisors prior to the examination committee presentation.

7- INCENTIVES

❖ College Prize (each semester)

Top two projects based on Overall grade, Quality of final report, and Department evaluation.

❖ SABIC Prize (annual)

Best two projects based on Department Committee evaluation.

❖ GCC Prize (annual)

Best project based on College committee evaluation.

8- FINAL REPORT STRUCTURE

Components of a Written Final Report

- Title Page (Cover page + Information pages)
- Summary
- Acknowledgment
- Table of Contents
- List of Figures
- List of Tables
- Body of Report
- References
- Appendices (Optional component)

9- FINAL REPORT CONTENT

1- Title page

2. Executive summary:

- Includes a brief description of the objectives of the project
- Cites the main constraints (design, economics, safety, environment)
- Includes main findings of mass & energy balance, design results, and economic analysis.

3. Acknowledgement

4. Table of Contents

5. List of Figures

6. List of Tables

7. Introduction:

- Physical & chemical properties of the desired product and the raw materials.
- The product main uses and applications with focus on local market.

8. Project statement

- Clear description of the project objectives.
- Cites overall design constraints, economic constraints, safety, and environmental constraints.

9. Process options (Industrial Flow sheets not allowed)

- Include a survey of the main routes for the production of the desired product.
- Include technical comparison between the main routes
- Cite criteria for the selection of the desired route (technical, economical, and so on)
- Description of the selected process Flow Sheet (drawings are to be made by computer and should not be cut and pasted).

10. Mass and energy balance calculations.

- Assumptions and basis, rates, and so on.
- Include overall and unit per unit mass and energy balance (with a schematic diagram of each unit). Clearly state the desired unknown variables. Hand calculations are required.
- Computer applications are also required with details described in the appendix.
- Comments and discussion of the overall results and for each unit as well.
- Comparison between hand and computer calculations is encouraged.

11. Detailed Design

- Detailed design of at least 1 unit per student. Brief re-description of the unit and the design, safety, and environmental constraints associated with it.

- Presentation of design equations that include the cited constraints as well as justified assumptions of the calculations.
- Only hand calculations are accepted.
- If computer simulations are used, the method of solution should be explained.
- Sensitivity analysis for the effect of design and operating parameters of the unit.
- Summary of design results.
- Discussion of design results.

12. HAZOP

- Prepare a HAZOP study for at least three nodes. Identify major hazards and necessary actions, if possible prepare start up and shut down operations procedures for major equipment.
- Summarize the conclusions in relation to the design of the plant

13. Environmental Impact Analysis

- Checking emission against international standard for allowable limits of disposal to land or sea.
- The treatment of unwanted chemicals (by-products) and the concentrations of liquid discharges and gaseous emissions during normal operation.
- The handling of a major chemical accident, including all chemicals within the plant and any subsequent reaction products, and containment and clean up.

14. Economic analysis

- Profitability analysis
- Analysis of the effect of uncertainties of the process and cost variables on the project profitability.

15. Control loops

16. Conclusions and recommendations

17. Table of nomenclature

18. List of references

19. Appendices

- All data used in calculations
- Results of software calculations
- Figures or Tables used in calculations

10- FINAL REPORT FORMAT

Typing Specifications

- ❑ Page Format
 - Line Spacing: one and half spacing
 - Font Size: 12 point for the body text, maximum of 14 point Bold for section headings
 - Left/Right Margins: 2.54 cm
 - Top/Bottom Margins: 2.54 cm
- ❑ Page Limit
 - The page limit for the report is 80-120.
 - There is no page limit to Appendices.
 - Title Page: Title of the project, followed by names of team members, department, Fall/Spring AY 201x – 201x, and date of submission.

Units

- Units of all quantities must always be mentioned, e.g., 5 kg, 3 lbs, etc
- Use the same unit system throughout the report (SI units, British units, etc.)

Figures, Tables, and References

- All Figures, Tables, and Graphics should be inserted close to where they are described and numbered. A list of figures is also required.
- Figure Captions should be below the figures.
- Table Captions should be above the Tables.
- References: a list of references must be provided at the end of the report and arranged in the order of citation in the text.
- Number Reference citation consecutively in square brackets.
- The references must be complete and precise, e. g., name of the author (Book, Encyclopedia); Title, volume, page number, year month, editor, and electronic address.

Calculations

- All calculations must be hand calculated, detailed, explained, and referred to figures and illustration whenever necessary.
- Software Packages can be used in addition to hand calculations but must not replace hand calculations.
- All symbols must be defined in nomenclature.
- All equations must be numbered and typed using equation editor with 12" size and Times New Roman italic type

TITLE PAGE



**King Saud University
College of Engineering
Department Name**

Project Title (Arial Black Font 18)

By

Student#1 name (student ID)
Student#2 name (student ID)
Student#3 name (student ID)

*Submitted in partial fulfillment of the requirement for the degree of Bachelor of Science in
Department Name
in College of Engineering, King Saud University*

1ST Semester

143x – 143x H - (201x-201x G)

INFORMATION PAGE (LOOSE)

We hereby approve the report entitled:

Project Title (font 14)

Prepared by: Student#1 name (Student ID)
 Student#1 name (Student ID)
 Student#1 name (Student ID)

Advisors: Dr. ***** Signature _____
 Dr. ***** Signature _____

Date: _____

143x – 143x H - (201x-201x G)

INFORMATION PAGE (LOOSE)

The following personal information should be included at the end of the report.

بيانات شخصية:

الإسم:
البريد الإلكتروني:
العنوان:
المدينة:
الرمز البريدي:
ص.ب.:
تليفون:
جوال:

The following personal information should be included at the end of the report.

Name:
Email:
Address:
City:
Telephone:
Cell phone:

CHECKLIST

Problem Statement page	
Summary page	
Title page	
Information page	
Consistent Engineering Units	
Sensitivity analysis of plant economics and comments	
Coherence of introduction section with the rest of the report	
Connection to local existing industries	
Approximation of design parameters to standard nominal values	
Consistent Reference's format following standard style	
Nomenclature page	
Preserving copy rights in text, figures, tables, etc.	
Proofreading the final report	
Summary content includes context of the project, major findings, the conclusions, and main recommendations	
Concise conclusion including purpose and most important results providing specific quantitative information	
Recommendation page	
Hand calculation of cost analysis	
Environment allowable limits for emission and waste	
Integration of HAZOP and P&ID	
P&ID consistent with standard symbols and diagrams	