UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Engineering, Built Environment and Information Technology

Fakulteit Ingenieurswese, Bou-omgewing en Inligtingtegnologie / Lefapha la Boetšenere, Tikologo ya Kago le Theknolotši ya Tshedimošo

1956 – 2016 60 years of Engineering Education

School of Engineering
Department of Industrial and Systems Engineering

Industry Guidelines for Final Year Projects 2021

1. INTRODUCTION

As part of the pre-requisites for the bachelor's degree in Industrial Engineering, final year students are required to complete an engineering project in which they apply fundamental industrial engineering knowledge and skills. The project, executed over two semesters from February to October each year, forms an essential part of the training and industry exposure of Industrial Engineering students at the University of Pretoria. The project carries a total of 40 credits or 400 learning hours, equivalent to approximately 2.5 months of full-time work.

Industry support is essential to identify and oversee suitable projects and to support students in executing their projects. The aim of this document is to provide students and companies interested in partnering with the Department with respect to final year projects the following:

1) an overview of the module and deliverables, and the competencies students must demonstrate with the projects,
2) guidelines for nominating and overseeing projects,
3) the policy of the University with respect to copyright and ownership of intellectual property.

This document, as well as other information pertinent to project definition and completion, are accessible via https://www.up.ac.za/industrial-and-systems-engineering/article/2662756/final-year-projects, with the following web links of special interest, as explained in forthcoming sections of this document:

1. Engineering Council of South Africa (ECSA)
   https://www.ecsa.co.za/education/EducationDocs/E-02-PE%20Qualification%20Standard%20for%20Bachelor%20of%20Science%20in%20Engineering%20BSc-Eng_Bachelors%20of%20Engineering%20BEng_NQF%20Level%208.pdf
2. Departmental web site:
   http://www.up.ac.za/industrial-and-systems-engineering/
3. Ethical clearance
   http://www.up.ac.za/en/faculty-of-engineering-built-environment-it/article/15815/faculty-committee-for-research-ethics-integrity

2. PHASES AND MODULES

The project is executed sequentially over two semesters in two modules, referred to as BPJ 410 and BPJ 420. Table 1 lists the phases, deliverables and **tentative schedule**.

Table 1 Overview of BPJ410 and BPJ420

Module	Phase	Deliverable	Schedule Due Dates
BPJ 410	0	Project Topic/Project Definition	30 March (Tue)
	1	Project Proposal	28 April (Wo)
	2	Preliminary Project Report	17 June (Thu)
		Reflection on Learning	
BPJ 420	1	Interim Project Report	**Second semester** To be published in the BPJ 420 study guide
	2	Final Project Report	
	3	Poster	
		Oral Presentation	

3. MODULE COORDINATION

Industry partners are welcome to contact the following module coordinators with any queries regarding the final year projects:

Table 2 Coordinators

Name	Telephone No	e-mail
Prof Marné de Vries	012-420-2038	marne.devries@up.ac.za
Ms Saija Bezuidenhout	012-420-2820	saija.bezuidenhout@up.ac.za

Each year, the department appoints a lecturer/specialist to supervise the students. Students are required to discuss their proposed projects with potential supervisors before submitting the Phase 0 deliverable.

4. MODULE OUTCOMES

The purpose of the final year project (BPJ 410 and BPJ 420) is to provide a student with an opportunity to demonstrate:

1) competence in certain Graduate Attributes (GAs) specified by ECSA (2019) and
2) compliance to the requirements prescribed by the University to be awarded the B. Eng. Degree.

The following outcomes stipulated by the Engineering Council of SA (ECSA) apply to BPJ 410 and/or BPJ 420. The implication is that a project must provide a student with opportunities to demonstrate these competencies:

4.1.1 **GA 1:** Identify, formulate, analyse and solve complex engineering problems creatively and innovatively. Students achieve this outcome once they complete their project, demonstrating competence to:

1) Analyse and define an opportunity for improvement, and criteria for an acceptable solution.
2) Identify necessary information and applicable engineering and other knowledge and skills.
3) Generate and formulate possible approaches to the solution of the problem.
4) Model and analyse possible solution and select the best solution.

4.1.2 **GA 2:** Apply knowledge of mathematics, natural sciences, engineering fundamentals and an engineering speciality to solve complex engineering problems. Students must demonstrate that they are capable of applying knowledge of the mentioned sciences from first principles to investigate an environment, to identify project-related opportunities for improvement and to develop a proposal that will resolve the problem/exploit the opportunity.

4.1.3 **GA 3:** Perform creative, procedural and non-procedural design and synthesis of components, systems, engineering works, products or processes. Students are required to demonstrate competence in the ELO as follows:

1) Plan and manage the design process, develop supplementary methods, tools and or techniques that can assist them with a design/solution.
1) Acquire and evaluate the requisite knowledge, information and resources: apply the correct principles, evaluate and use design tools.
2) Perform design tasks including analysis, quantitative modelling and optimisation.
3) Evaluate alternatives and preferred solution: exercise judgement, test feasibility and perform techno-economic analysis.
4) Communicate the design logic and information.

4.1.4 **GA 4:** Demonstrate competence to design and conduct investigations and experiments. Students must demonstrate that they are capable of investigating and understanding a project environment, existing knowledge, the gathering and documenting of pertinent information and data, and using the former to develop of a potential solution for the identified opportunities for improvement. This entails:

1) Investigate and represent the problem and problem environment.
2) Analyse existing literature that can assist in design and/or problem solving.
3) Gather the necessary input data required for problem solving.
4) Analyse data gathered during problem investigation.

4.1.5 **GA 5:** Demonstrate competence to use appropriate engineering methods, skills and tools, including those based on information technology. Students are required to:

1) Identify available industrial engineering methods, tools and/or techniques that can be used in design and/or problem solving.
2) Select the most appropriate method(s), tool(s) and/or technique(s) for design/problem solving.
3) Develop supplementary methods, tools and or techniques that can assist them with a design/solution.

4.1.6 **GA 6:** Demonstrate competence to communicate effectively, both orally and in writing, with engineering audiences and the community at large. The department requires the student to document their projects in a scientific, professional and appropriate style, to present the project orally and portray the project visually by means of a poster.

4.1.7 **GA 7:** Demonstrate critical awareness of the impact of engineering activity on the social, industrial and physical environment. Student must consider the potential social and ethical implications of their projects.

4.1.8 **GA 9:** Demonstrate competence to engage in independent learning through well-developed learning skills. Students need to demonstrate an ability to learn independently during all phases of the project, but specifically during problem investigation and literature analysis.

4.1.9 **GA 11:** Engineering management. As part of their final year project, students are required to apply project management principles to plan and manage the successful completion of their projects.

These attributes provide an indication of what a project should entail and what an organisation can expect to gain from a project.

5. PHASES AND DELIVERABLES

5.1 First Semester

As indicated in Table 1, the first deliverable is the **Project Topic**. It is the responsibility of the student to acquire a suitable project and an industry sponsor, and to submit a document that describes the project. Students may select their own projects, as long as the project provides sufficient opportunities to apply industrial engineering methods, techniques, tools and skills that will enable the student to demonstrate compliance with ECSA's graduate attributes.

To support students in acquiring a suitable project, companies and lecturers are invited to propose potential projects by e-mailing a **Project Definition**[1] to the module coordinators by the latest 15 February 2021. The Project Definition should provide sufficient detail to allow a) a student to select the project based on his/her areas of interest and b) the course coordinator to make a judgement on the suitability of the project, and c) to allocate a project leader with the necessary expertise.

When proposed project definitions are received, the Department will advertise them on the Industrial Engineering website. Students can then apply for a project by following the application process detailed in the Project Definition by the *Industry Mentor*, typically by submitting a CV and a motivation to the company, often followed by interviews and a final selection. Students that are not selected must then search for another project, often under time constraints due to the limited time that may be left before the submission date. It remains the responsibility of each student to find a suitable project.

Students, when liaising with companies to identify projects, especially companies that collaborates with the Department for the first time, must ensure that the company is aware of the University's policy regarding intellectual property ownership, as discussed in section 7 of this document.

Phase 0 is deemed to be completed when the student submits a **Project Definition** and a completed **Project Mentorship Form,** signed by the industry mentor. By signing the form, the industry mentor approves of the study undertaken by the student, commits to providing the students with the required support to complete the project, and accepts the stipulations regarding intellectual property.

The next deliverable is the **Project Proposal,** which is a more detailed description of the problem/needs requirement, the project aim, and a broad outline of an envisaged project approach, scope and deliverables based on an initial investigation of the problem/process and a preliminary literature study.

[1] Suggested template is available at and examples of Project Definitions are available at: https://www.up.ac.za/industrial-and-systems-engineering/article/2662756/final-year-projects.

The first semester concludes with the student submitting two examination deliverables. The **Preliminary Project Report** should communicate some background information about the company, industry, process, problem and aim, provide a detailed envisaged project approach and expected deliverables based on a thorough problem/process investigation and a detailed literature study. The second deliverable is a document that demonstrates competence to **Outcome 9: Reflection on Learning**.

5.2 Second Semester

The work initiated by the student during the first semester culminates in the deliverables required for BPJ 420, as listed in Table 1. In the second semester the student must complete the project and, in doing so, fulfil the obligations to the company in terms of expected and agreed-upon deliverables, as initiated in the **Project Definition** and finalised in the **Final Project Report**. These deliverables should include considering and evaluating alternative solutions, proposing (not necessary implementing), and validating/ demonstrating that the preferred solution will fulfil the project aim. Care should be taken not to make implementation part of the agreed-upon deliverables, unless all variables that could affect implementation are within the control of the student.

6. KEY RESPONSIBILITIES OF INDUSTRY PROJECT MENTORS

The involved company is requested to appoint a project mentor, which is the key contact within the company that should be able to provide the best guidance on the project and is most likely to gain from the success of the project. The project mentor has the following important responsibilities:

1. Selecting a suitable student/candidate to conduct the project.
2. Confirm his/her role as project mentor, duly authorised by the company by signing the **Project Mentorship Form**. Multiple mentors can be appointed, but is not advised.
3. Ensure that the **Project Definition** adequately describes the project.
4. Review and approve the **Project Proposal**, ensuring that it clearly defines the problem to be investigated by the student and that the project aim, scope, deliverables and approach is acceptable.
5. Review and approve the **Final Project Report**, ensuring that information is accurate and the solution addresses the problems and/or design requirements of the defined project.
6. Ensure that sensitive confidential information or intellectual property of the company is not disclosed in the document and/or that the necessary arrangements are made with the Department regarding the handling of the reports.

7. INTELLECTUAL PROPERTY OF PROJECT REPORTS

The University of Pretoria has Intellectual Ownership of all outcomes generated by students, including the project documents generated by the student as part of their final year projects. The University may publish final year projects on UPSpace and thus make the reports freely available on the Internet.

These publications portray the quality of education at the University, but they have the potential of exposing sensitive company information. It is important that both students and sponsors are aware of such implications.

In this regard, the Student must arrange with a company how to address confidential information and ensure that deliverables do not contain any confidential, sensitive or proprietary information of the company. The following is potential actions that could be taken to protect company sensitive or confidential information:

- Making use of a fictitious name to represent the company, for example, referring to Company ABC.
- Withholding, excluding or adjusting important confidential or sensitive data, such as design drawings or financial information.

- Coding sensitive data, for example, by adding or subtracting a constant from all values.
- Requesting the Department not to publish the deliverables on UPSpace.

The position of the Department Industrial and Systems Engineering is that:

1) It remains the responsibility of the student to come to an agreement with the company on handling confidentiality and sensitive data.
2) Only certain selected final project reports are published on UPSpace. If a company request so, the Department will not publish the involved project report (or any other deliverable) on UPSpace or any other web site/means by which it can be accessed by third parties.
3) All deliverables are made available to the internal and external examiners only through secured means. If the company wishes to exclude certain information from the eyes of the examiners, the student must use the advice contained in the policy statement above. Obviously, the more information is withheld, the more difficult it becomes to assess the competencies of the student fairly.

8. ADDITIONAL INFORMATION

8.1 Practical Training

Besides the final year projects, all engineering students must also complete practical training at an approved organisation, during or at the end of their second and third study years. This entails a six week (30 working days) period per year of study with a total of twelve weeks. On completion of each training period, a student must submit a report that is evaluated by the university in terms of standard, quality, quantity and field of application for the student's field of study.

Companies interested to make use of this opportunity can get more information on the Department's web site.

8.2 Ethical implications

Student must consider the potential social and ethical implications of their projects and, if applicable, apply for ethical clearance at the relevant faculty ethics committee. These include studies in which human participants are informants (i.e. surveys, questionnaires, interviews). Guidelines are provided by the Faculty Committee for Research Ethics and Integrity (Faculty of Engineering Built Envirnment & IT, 2020).

8.3 Plagiarism

Plagiarism is not tolerated by the University. Students must adhere to the requirements stipulated in the Plagiarism Policy Document (University of Pretoria, 2019).

8.4 Professional conduct

Students are expected to conduct themselves professionally in dealings with sponsors and personnel.

9. CONCLUSION

The Department wishes to thank all companies that collaborated/intent to collaborate with the Department in this matter, and acknowledges the resulting contributions in educating future industrial engineers.

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