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

MIA 320
Impact of Engineering and Groupwork

Study guide

Department of Mechanical and Aeronautical Engineering

Compiled by: Mr Bradley Bock

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SECTION A: ORGANISATIONAL COMPONENT

1. Introduction

1.1. Background to course

This course aims to meet two key outcomes, namely to ensure students can work in a multidisciplinary group and that they understand the impact of engineering on the world at large.

Groupwork

Multidisciplinary work is a given for engineering in the workplace. Products and projects are all multi-disciplinary in the modern world, with a common example of electronics and software having been integrated into even the most mechanical or electrical of components.

Furthermore engineers must work with project managers for coordination, motivate to project financiers for funds and liaise with customers and stakeholders to ensure projects outcomes meet the original intent.

Impact of Engineering

The impact of engineers has been immense on humankind's progress and current state. From successes such as improved living conditions and lifespans to failures such as pollution and global warming, the output of engineers are arguably humankind's greatest achievements.

Engineering students thus need to be made aware of how our work will influence the world around us, with the best solution not necessarily being the cheapest most technically impressive option, but rather the solution that also weighs the impact on the environment, society and culture.

Besides the moral implications of this influence we wield, many of these influences have legal implications, with various Acts and laws designed to prevent damaging influences.

1.2. Course Aim

Groupwork

To prepare engineers for working in multidisciplinary groups.

Impact of Engineering

To ensure student engineers better understand the influence their work has, be it on the environment, society or workplace, and understand some of the legal ramifications thereof.

1.3. Course structure

Groupwork

A semester project where individuals work as a group, with their results assessed through reports and an oral exam.

Impact of Engineering

Lectures based on theory and case studies, assessed through tests and exams.

1.4. Tie-in with other modules in the programme

Each department's final year design project will require an understanding of the impact of the engineer's design, while groupwork will be a common feature of many courses.

1.5. Departmental study guide

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

English:
http://www.up.ac.za/media/shared/120/Noticeboard/2017/departmental-studyguide-eng-2017.zp107056.pdf

Afrikaans:
http://www.up.ac.za/media/shared/120/Noticeboard/2017/departementele-studiegids-afr-2017.zp107058.pdf

2. Administrative Information

2.1. Contact information

	Name	Office	E-mail address
Module Coordinator, Lecturer	Mr. Bradley Bock	Eng III, 6-84	bradley.bock@up.ac.za
Lecturer	Dr. Mehdi Mehrabi	Eng III, 6-82	mehdi.mehrabi@up.ac.za

The contact details of the teaching assistants will be made available on clickUp

2.2. Time Table

Contact Session	Venue	Day & Time
Lectures/Tutorials	AE Audit, Eng III-7	Monday: 10h30 – 11h15
Lectures/Tutorials	AE Audit, Roos Hall	Thursday: 11h30 – 13h15

Due to the size of the class, students will often be split between lecture venues, depending on the nature of the lecture or tutorial session.

This information will be communicated via clickUp to students.

2.3. clickUp Access

Please note that clickUp will be used to communicate all announcements throughout the course as well as for learning and assessment. Furthermore a significant portion of groupwork will be conducted and aided by clickUp.

It is the student's responsibility to ensure they have access to the clickUp course for MIA320.

2.4. Consulting Hours

It is recommended to use the lecture session and tutorial sessions available each week to consult with the lecturers and teaching assistants. This time has been made available for this very purpose and as such should be used.

All extra consultations that are required for matters that are perhaps not suitable for the classroom environment must be done by booking an appointment through email with the respective lecturer or teaching assistant.

3. Study materials and purchases

3.1. Textbook

The following textbook is prescribed:

Title: The Impact of Engineering on Society – A Multidisciplinary Approach
Edition: 3rd
Author: University of Pretoria, MIA 320
Pearson Custom Publishing
ISBN 978-1-78726-013-9

3.2. Additional Notes

Any notes on study material not covered in the textbooks will be made available in electronic format on Click-Up. These lectures will also be part of the syllabus.

Lecture slides will also be made available on Click-Up. Please note that these lecture slides do not cover all the work discussed in class and students should take down their own supplementary notes during lectures.

Problem solutions covered in detail during the lectures will not be made available again at a later stage.

4. Expectations from Lecturers and Students

4.1. What is expected from Lecturers

- Courteous and professional in all interactions with students
- Well prepared for lectures
- Fair in all decisions

4.2. What is expected from Students

- Courteous and professional in all interactions with each other and lecturers/TAs
- On time hand in of all deliverables
- Disciplined behaviour in class
- Discussion of problems in/with course with lecturer as soon as possible in a professional manner

SECTION B: STUDY COMPONENT

5. Assessment

5.1. Assessment Breakdown and sub-minimums required

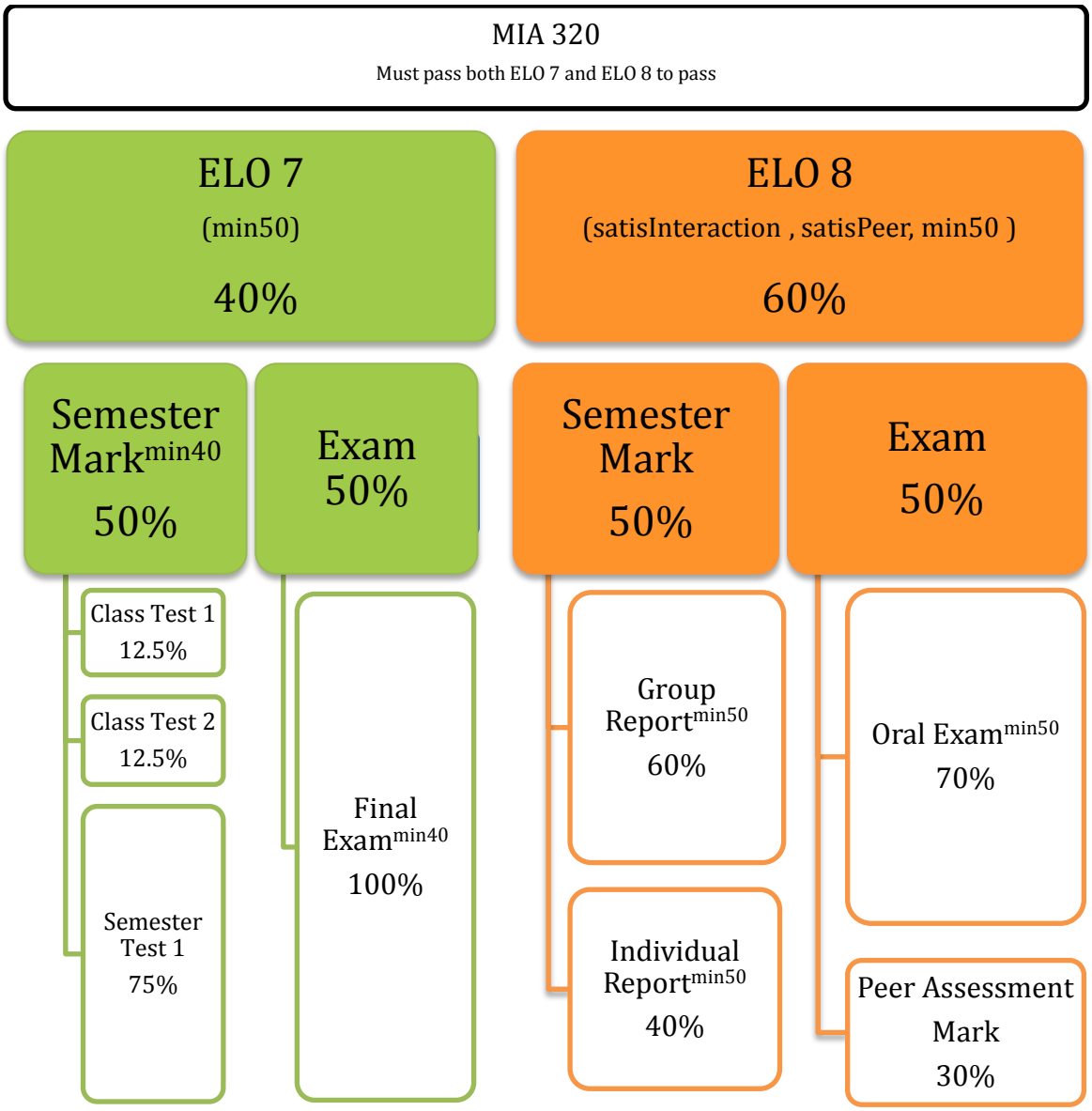

Figure 1. Illustration of assessment breakdown for MIA 320

The explanation for the sub minimums noted in Figure 1 is as follows:

- min40 Subminimum of at least 40% required to pass course
- min50 Subminimum of at least 50% required to pass course
- satisPeer At least a satisfactory on peer assessment required to pass course
- satisInteraction At least a satisfactory on Groupwork interaction form required to pass course

MIA 320 assesses a student's ability in both ELO 7 (Impact of Engineering Activity) and ELO 8 (Groupwork) and combines the two into a final mark.

Please refer to Figure 1 for an illustration of how the final mark is calculated as well as the various subminimum required.

Please refer to Appendix A for a more complete description of the above criteria. Please note that Appendix A is the legally binding interpretation of all rules, with Figure 1 merely for illustrative purposes.

5.2. Exam Entrance

Students must have a minimum average of 40% for ELO 7 semester mark in order to get exam entrance,
AND
Students must have a minimum average of 50% for ELO 8 final mark (thus ELO 8 exam and semester mark combined) in order to get exam entrance.

5.3. ELO 7 Assessment

As part of the assessment for ELO 7, the following assessments will take place. All will be multiple choice questionnaires:

- Two class tests will be written during the semester, both on clickUp.
- One semester will be written in the second test week
- A written exam

5.4. ELO 8 Assessment

5.4.1. Project Protocol

The protocol is the agreement between the group and the Teaching Assistant [acting on behalf of the Lecturer] regarding the scope of work. Once the protocol has been accepted by both parties, it cannot be altered unless a formal paper trail is in place and signed off by the Teaching Assistant.

The protocol must be a one page document stating the project topic, the scope of the project, its objectives, user requirements and deliverables. It was also contain the work break down structure of the project.

Details regarding the format of this document will be discussed during the introductory lecture.

5.4.2. Work Breakdown Structure

The work breakdown structure will consist of a project schedule and a responsibility matrix

The project schedule should be in the form of a detailed Gantt chart.

The responsibility Matrix must clearly highlight the duties of each team member and how they fit into the overall scope of the project. It is the responsibility of each team member to clearly incorporate his role and responsibilities in the scope of the project.

5.4.3. Peer assessment

Each student must complete the Peer Assessment process whereby they score themselves in terms of their contribution to the semester project as well as the contribution of their peers to the project.

The Peer assessment mark will be calculated as follows:

$$\boldsymbol{Peer\ Assessment\ Mark\ =\ Peer\ Review\ Factor \times Oral\ Exam\ Mark}$$

Where the Peer Review Factor will depend on the rating your peers give you. This will be explained in further detail during the peer assessment process.

The peer assessment can also determine whether you pass or fail the course, as your peers must mark your contribution toward the course and if at least a 'satisfactory' is not achieved, you will fail the course. (Refer to Figure 1 and Appendix A for further context).

5.4.4. "Firing" a group member

Individual group members can be fired by their colleagues. Please note that this will lead to that group member failing the module.

A group member can only be fired if:

- The group member received a written warning (a written warning consists of an email to the offending student with the course co-ordinator, Mr Bradley Bock, CC'd) stating the reason of the warning, with explanation e.g. noting deadlines that may have been missed.
- On his/her 3rd offence the student must be asked by the group to attend a disciplinary hearing, consisting of the CEO, the offending student and a Lecturer or Teaching Assistant. After the disciplinary hearing the student will be informed if the lecturer/teaching assistant agrees with the dismissal.

Please note that the availability of this tool is not to be taken lightly. Firing a group member would mean that that person FAILS the module automatically. However, experience has shown that some students choose to ignore deadlines etc. at the detriment of the group.

This tool is to be used with maturity, honesty and professionalism.

5.4.5. Group Report

The group report is a formal technical report and should clearly and professionally communicate the project to the reader.

5.4.6. Individual discipline specific engineering report

Each student must write a report summarizing all the engineering activities that he/she performed (in accordance to the "Responsibility Matrix") for the project.

Examples of "engineering activities" include: calculations, designs, simulations, summary of literature reviewed, layouts etc.

Examples of non-"engineering activities" are: Compilation or editing of reports, posters or presentations, general management and non-project related logistics.

This document must showcase the student's skill in their own engineering field.

5.4.7. GroupWork Interaction Form

The group work interaction form details the interaction between the various team members and must be submitted together with the final reports.

At least a satisfactory needs to be achieved for the groupwork interaction report in order to pass the course.

5.4.8. Oral Exam

Each group must produce a presentation to an examination team. The team will consist of internal lecturers from the University of Pretoria as well as external industry representatives.

The presentation will take place during exams and the time and venue of this presentation will be communicated closer to the end of the semester.

6. Course Outcomes

6.1. ELO 7 Outcomes

a. An understanding of how technology can impact society with regards to the history of Engineering, modern day Engineering, philosophy and risk.
b. An introduction to the Occupational Health and Safety Act of South Africa and the application thereof.
c. The impact on Engineering on the physical environment with respect to Air Pollution, Water Pollution, Water Quality Control and Solid Waste.
d. The personal, social, cultural values and requirements of those affected by engineering, where it is in the work place or in society.
e. An understanding of sustainability in engineering.

6.2. ELO 8 Outcomes

a. The student works on a multi-disciplinary group project whereby:
    i. The student acquires a working knowledge of his/her co-workers' discipline/s.
    ii. The student is exposed to a systems approach.
    iii. The student is able to communicate across disciplinary boundaries.
b. The student works on a discipline specific portion of the multi-disciplinary group project, as an individual and with other engineers whereby:
    i. He/She can identify and focus on objectives specific to his/her discipline whilst acknowledging the impact of his/her technical input on his/her co-workers/the environment/society.
    ii. He/She can work strategically towards the success of the project.
    iii. He/She executes tasks effectively.
    iv. He/She delivers completed work on time.
    v. He/She can make individual contribution to team activity.
    vi. He/She performs critical functions within the project that no other person can perform.
    vii. He/She enhances work of fellow team members.
    viii. He/She benefits from support of team members.
    ix. He/She communicates effectively with team members.

7. Themes – ELO 7 – Impact of Engineering Theoretical Study

This section of the module is comprised of the following study themes:

Theme	**Number Of Lecturers**
1. Engineering, sustainability and society	3
2. Engineering and the environment	7
3. Personal, social, cultural values and requirements of those affected by engineering activity	4
4. Health and Safety	2

Fundamental concepts:

For each study unit, ***fundamental concepts*** have been identified. The student must be able to explain each of these concepts properly and illustrate them where applicable.

Learning outcomes:

For each study unit, clear ***learning outcomes*** have been identified. These outcomes form the basis of the assessment of ELO 7. While studying the learning outcomes, it is critical that the student note the cognitive domain in which each of these outcomes must be mastered.

7.1. STUDY THEME 1: Engineering and society

Sub-Theme	Source	Description
Engineering in history and the modern era (1 lecture)	MIA 320 Textbook Chapter 1	• The technological formulation of human society • The scientific revolution and the rise of capitalism • The industrial revolution • Innovators and steam power • The spread of industrialization • Case study: The Panama canal
	MIA 320 Textbook Chapter 2	• The automobile industry and changes in production • Engineering and infrastructure • From early flight to the space program • Electronic industry and development of computers • Modern manufacturing • System theory and system engineering • Taylor scientific management
Innovation, development and technology transfer (1 lecture)	MIA 320 Textbook Chapter 4	• The innovation process • Invention • Innovation • Design • R&D • Effects of trends and cycles • Essential interactions and driving forces • Social context of innovation • Consumer rights, product liability
	MIA 320 Textbook Chapter 5	• Economic definition of development • Social implications of under development • Development of underdevelopment • Foreign aid and debt crisis • Broader definition of development • Range of technologies • Technology transfer • Global engineering practice
Sustainability	Class notes	• What is sustainability? • How does this affect engineering projects? • How does economics affect sustainability

Fundamental concepts:

Explore the impact of technology on society

Learning outcomes:

1. Understand the importance of the impact of engineering and technology on society.
2. Act accordingly

Self-study:

Read through MIA 320 Textbook chapters 1, 2, 4 and 5

7.2. STUDY THEME 2: Engineering and the Environment

Sub-Theme	Source	Description
Water Pollution (2 lectures)	MIA 320 Textbook Chapter 10	• Pollutants • Groundwater • Aquifers • Hydraulic Gradients • Darcy's Law • Contaminant Transport • Control of Groundwater Plumes
Air Pollution (2 lectures)	MIA 320 Textbook Chapter 12	• Emissions • Pollutants • Pollutions in Megacities • Motor Vehicles emissions • Sources • Point Source Gaussian Plume Model
Water Quality Control (1 lectures)	MIA 320 Textbook Chapter 11	• Wastewater systems • Water Treatment Systems • Hazardous Wastes • Land disposal
Solid Waste (1 lectures)	MIA 320 Textbook Chapter 13	• Types • Waste Management • Source Reduction • Recycling • Materials Recovery • Waste-to-Energy • Landfills

Fundamental concepts:
Explore the impact of technology on the environment
Learning outcomes:

1. Understand the importance of the impact of engineering and technology on the environment
2. Act accordingly

Self-study:
Pre-Read through MIA 320 Textbook chapters 10-13 to prepare for class

7.3. STUDY THEME 3: Engineering on a personal, cultural and social level

Sub-Theme	Source	Description
Philosophy of engineering (1 lecture)	MIA 320 Textbook Chapter 6	• What is philosophy • Branches of philosophy • Discovery in science • How do we know? – Epistemology • Free will and determinism
Sociological insights (1 lecture)	MIA 320 Textbook Chapter 3	• Sociological imagination • Social stratification • Gender differentiation • Racial and ethical differentiation • Consumerism and advertising • The social importance of work • What motivates engineers • Social power • Redefining engineering
Risk (1 Lecture)	MIA 320 Textbook Chapter 8	• Global Warming • Impacts on Society • Costs
	MIA 320 Textbook Chapter 9	• Perspective on Risk • Perception of Risk • Risk Assessment and Characterization • Hazard Identification
Ethics and professionalism (1 lecture)	MIA 320 Textbook Chapter 7	• Ethics and social responsibilities • Codes of Ethics • Ethics and the role of the expert • What is professional • The characteristics of modern professionals • Engineering associations

Fundamental concepts:

Explore the personal, social cultural values and requirements of those affected by engineering activities.

Learning outcomes:

1. Understand the importance of the personal, social, and cultural **requirements** of those affected by engineering activities.
2. Understand the importance of the personal, social and cultural **values** of those affected by the engineering activities.
3. Act accordingly

Self-study:

Read through MIA 320 Textbook chapters 3, 6 to 9

7.4. STUDY THEME 4: Occupational Health and Safety Act

Sub-Theme	Source	Description
Occupational health and safety act (2 lectures)	Class Notes MIA 320 Textbook Part 4	• Guest lecture

Fundamental concepts:
Understand and know how to apply the occupational health and safety act.
Learning outcomes:
1. The student must be able to apply his knowledge of the OHSA to a realistic/real life situation.
Self-study:
www.labour.gov.za

8. Themes – ELO 8 – Groupwork

Students have been randomly grouped into multidisciplinary groups and must complete a paper project. The project topic will be given to each group. Each group will share a Teaching Assistant with approximately 10 other groups and must use the Teaching Assistant to guide them through the project.

The students will need to submit a protocol to their Teaching Assistant. Within the protocol, the group will need to explain in their own words what their project is about and provide a work breakdown structure indicating which group member is responsible for specific tasks. It is critical that the groups complete this task as soon as possible as it is the foundation of project.

Over and above this, groups will be require to keep a logbook documenting all the group activities during the semester as well as individual group work interaction forms documenting how each group member interacted with each other.

At the end of the semester the groups will present their work in the form of a **project data pack** (semester mark) and **oral presentation** (exam).

Appendix A: Full description of subminimums and mark determination

A.1 Requirements to Pass

In order to pass this module a student must:

- Meet the pass criteria for ***ECSA ELO 7***
  AND
- Meet the pass criteria for ***ECSA ELO 8***

The student will only pass the course if **BOTH** of the ELO's is achieved. Should a student only pass one ELO, the student will be required to redo the **ENTIRE** course in order to pass.

Pass Criteria for ELO 7

- Obtain a subminimum of 40% for the ELO7 semester mark (which consists of class tests and a semester test)
- Obtain a subminimum of 40% for the ELO7 written exam (which is the written exam)
- Obtain a subminimum of 50% for the ELO7 final mark (weighted average of the ELO7 semester mark and ELO7 written exam)

Pass Criteria for ELO 8

- Obtain a subminimum of 50% for the ELO8 semester report (both the group report and the individual report)
- Obtain a subminimum of 50% for the ELO8 Oral exam
- Obtain a subminimum of 50% for ELO 8 final mark (weighted average of the ELO8 semester mark and ELO8 exam mark)
- Obtain at least a satisfactory on the peer review of your groupwork performance
- Obtain at least a satisfactory on the groupwork interaction form

A.2 Determination of the Final Mark

The final mark is compiled as follows:

Evaluation method	Contribution	Total
Semester Mark	50% • 20% ELO 7 • 30% ELO 8	**50%**
Exam	50% • 20% ELO 7 • 30% ELO 8	**50%**
TOTAL		**100%**

A.2 Determination of the Semester Mark

The semester mark will be determined as shown in the table below:

Evaluation method	Number of	Contribution of ea.	Total
ELO 7 Class Test	2	5%	**10%**
ELO 7 Semester Tests	1	30%	**30%**
ELO 8 Group Report • Group assessment • Individual assessment	1	60% • 36% • 24%	**60%**
TOTAL			**100%**

A.3 Determination of the Exam Mark

The exam mark will be determined as shown in the table below:

Evaluation method	Number of	Contribution of ea.	Total
ELO 7 Exam	1	40%	**40%**
ELO 8 Oral • Group assessment • Peer assessment	1	60% • 42% • 18%	**60%**
TOTAL			**100%**