# UNIVERSITY OF CAPE TOWN

## Department of Electrical Engineering

## EEE4022F/S - Final Year Project

## Graduate Attribute Tracking Form

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|---|---|---|---|
| Student name: | Zuhayr Loonat | DP Awarded? [Y/N] | |
| Student no: | LNTZUH001 | Supervisor name: | Justin Pead |
| Date: | 23/09/2024 | Date: | |
| Student signature: |  | Supervisor signature: | |

**VERY IMPORTANT: Receiving DP for the course does NOT imply that all GA's have been met in the course. Assessment of GA's only happen in the final marking of the project report.**

**GA 1: Problem Solving**

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| Student Response:<br>During this course I have done research on salinity measurements. This included techniques used for measuring salinity, their use cases and the mathematics behind conductivity methods used for salinity calculations.<br>Using this research, I created a salinity measuring device that uses conductivity, temperature and depth (CTD) to measure salinity in salt water. This device required me to build a PCB and meet specific requirements, such as size and cost constraints. I had to carefully choose components and build the PCB with good practice methods used. I plan to then program this device to measure and calculate the salinity using the mathematics I researched.<br>I have also researched Machine learning methods that can be applicable to creating a prediction or mapping model between the impedance of the salt water and its salinity. This then led to me researching Electrical Impedance Spectroscopy, which I found, should allow me to accurately create my ML model. |
| Supervisor Response: |

**GA 4: Investigations, Experiments, and Data Analysis**

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| Student Response:<br>I am designing a device that measures conductivity of saline solutions. Using this device, I will run an Electrical Impedance Spectroscopy measuring across the saline solution. Here I will compare the input wave to the output over the saline solution to calculate the impedance. This will be done over multiple different input waves and solutions of varying salinity to create a wide enough dataset to feed into the ML model. Here I will also use the probes to measure the salinity directly to find out the accuracy of the system and if any improvements should be made in future iterations. |
| Supervisor Response: |

**GA 5: Use of Engineering Tools**

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| Student Response:<br>For the hardware component of this project, I design a PCB. I used KiCAD to design both the schematic and the PCB.<br>For the software component I plan to use VS Code and Arduino IDE with embedded C/C++.<br><br>For Testing and debugging I will use tools including Oscilloscopes and Multimeters.<br>For version control I have used Git and have a GitHub page for this project, allowing for easy changes and backing up of files.<br><br>For machine learning I plan to use python with jupyter notebooks. |
| Supervisor Response: |

**GA 6: Professional and Technical Communication**

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| Student Response:<br>During my project I have been writing a report that documents the research I have done, the processes I have taken and my results. This report will be formatted according to the specified format and will be handed in at the end of the project. By documenting my project and meeting the deadlines I will show my ability for communication. |

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| My project also includes an oral presentation at the end which will show my presentation skills and verbal communication skills.<br>Throughout this project I have and will submit all relevant tasks on time and have and plan to be punctual will all communication such as meetings. |
| Supervisor Response: |

**GA 8: Individual Working**

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| Student Response:<br>This project has shown that I have the ability to work individually, with research, design, experimentation and documentation. Where necessary I have attributed any work or ideas I have gotten from others to them. (i.e. I have referenced all sources) |
| Supervisor Response: |

**GA 9: Independent Learning Ability**

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| Student Response:<br>I have done significant research on salinity measurements, Electrical Impedance Spectroscopy, and Machine Learning algorithms. I have also designed a PCB, which involved learning about layered PCBs and interference, researching components, creating iterations to fix mistakes. This also included asking knowledgeable people such as my supervisor for advice on topics that I have some uncertainty on. |
| Supervisor Response: |

**Instructions:**

Students must explain in this document what they **have already done** and what they **plan to do** to satisfy each Graduate Attribute. Descriptions of each GA is provided below. Supervisors respond to the student's plans and current progress, providing additional comments or advice as they see fit. Once the student's progress is deemed sufficient (a few weeks before submission at the due date for this form), supervisors indicate that DP can be awarded.

**GA 1: Problem Solving**

Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences with holistic considerations for sustainable development.

- A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
- Conceptually based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
- A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
- Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline, much of which is at the forefront of the discipline.

**GA 4: Investigations, Experiments and Data Analysis**

Demonstrate competence to conduct investigations of complex engineering problems using research methods, including research-based knowledge, design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.

Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

The balance of investigation and experiment should be appropriate to the discipline. Research methodology to be applied in research or investigation where the student engages with selected knowledge in the research literature of the discipline.

Note: An investigation differs from a design in that the objective is to produce knowledge and understanding of a phenomenon and a recommended course of action rather than specifying how an artefact could be produced.

**GA 5: Use of engineering tools**

Demonstrate competence to create, select and apply and recognise limitations of appropriate techniques, resources and modern engineering and IT tools, including prediction and modelling, to complex engineering problems.

- Conceptually based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
- Knowledge of engineering practice (technology) in the practice areas in the engineering discipline

A range of techniques, resources and modern engineering and IT tools appropriate to the disciplinary designation of the programme.

**GA 6: Professional and Technical Communication**

Demonstrate competence to communicate effectively, both orally and in writing, with engineering audiences and the community at large, taking into account cultural, language, and learning differences.

This course evaluates the long report component of this outcome at exit level. Material to be communicated is in an academic or simulated professional context. Audiences range from engineering peers, management and lay persons, using appropriate academic or professional discourse. Written reports (10 000 to 15 000 words plus tables, diagrams and appendices) should cover material at exit-level. Methods of providing information include the conventional methods of the discipline, for example engineering drawings, as well as subject-specific methods.

**GA 8: Individual, Team and Multidisciplinary Working**

Demonstrate competence to work effectively as an individual, in teams and in multidisciplinary environments. This course evaluates the **individual** working component of this learning outcome at exit level.

Knowledge of professional ethics, responsibilities and norms of engineering practice.

**GA 9: Independent Learning Ability**

Demonstrate competence to engage in independent learning through well-developed learning skills.

Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

Operate independently in complex, ill-defined contexts requiring personal responsibility and initiative, accurately self-evaluate and take responsibility for learning requirements; be aware of social and ethical implications of applying knowledge in particular contexts.

- Openness to constructive feedback, awareness of own limitations, ability to cope with the discomfort of uncertainty and having access to a range of approaches, reflective self-evaluation, curiosity and proactive engagement, resilience, confidence to ask for help and draw from a broad range of stakeholders.
- Reflection of self-learning to begin to recognise if what has been covered meets the needs of the activity or task.