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| **Student name** | Sarah Tallack |  | **DP Awarded?** | Yes |  | No |  |
| **Student number** | TLLSAR002 |  | **Supervisor name** | R.A. **VERRINDER** | | | |
| **Date** |  |  | **Date** |  | | | |
| **Student signature** |  |  | **Supervisor signature** |  | | | |

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| **GA 1: Problem Solving** |
| **Student** |
| Proposal (Problem statement - 100 to 200 words) |
| The distribution of sea ice in the Southern Ocean’s Marginal Ice Zone (MIZ) plays a crucial  role in global climate patterns. Despite this, our understanding of this region suffers from lack  of in situ data measurement, especially over the winter season. Sea ice acts as both a reflective  boundary and physical insulator for the water below, affecting light transfer to the underlying  water. This in turn impacts the energy available for phytoplankton growth. Recent studies have  shown phytoplankton growth under sea ice in late winter, challenging previous assumptions that  sea ice melting preceded or concurred with significant phytoplankton growth [Hague and Vichi,  2021]. Phytoplankton play an important role in the global system, contributing to the carbon  uptake of the Southern Ocean, as well as acting as the base of the Antarctic region’s food  web. Thus, it become imperative to better understand the through-ice and under-ice radiative  transfer, especially for this unique region.  Research grade Photosynthetic Active Radiation (PAR) sensors are traditionally very expensive,  making them unsuitable for deployment in environments where they may not be recovered. The  development of a robust and affordable PAR sensor using off-the-shelf components would greatly  improve data measurement capabilities, and thus improve our understanding of this region. By  providing an affordable and reliable measurement solution, this project aims to fill the knowledge  gaps in Antarctic sea ice radiative transfer properties. This will in turn contribute to a deeper  understanding of the role played by the MIZ in the global climate system. |
| Outcome |
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| **Supervisor Response** |
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| **GA 4: Investigations, Experiments, and Data Analysis** |
| **Student** |
| Objectives of investigation (planned investigations, methods, and/or experimental procedure); Scope, assumptions and limitations of study |
| **Scope**  While the overall goal of this project is the development of the optical sensor-chain for through-ice deployment, the scope of this research project is limited to the development, testing and validation of a single sensor node using off-the-shelf components.  The sensor node should be designed so it can be implemented in a sensor-chain. Accommodations will also be made in the node design for additional sensors, such as temperature and conductivity (salinity) sensors.  **Limitations**  The extreme weather and oceanic conditions prevalent in the Antarctic region play a significant role in shaping the available design options for the sensor node. These conditions also impact the reliability and precision of the sensor, imposing limitations on its performance.  The project faces limitations due to the availability of required components within South Africa. The expenses and potential delays associated with shipping these components introduce additional constraints, which will affect the project's overall progress.  Additionally, another limitation may arise from getting access to a research-grade PAR sensor. This will be vital to validating measurements and calibrating the sensor node.  Finally, the tight design timeline of 13-weeks adds further limitations to what can be achieved in this project. This timeline will influence the extent of design refinement, testing and validation.  **Assumptions**  This project assumes that the observed late winter phytoplankton growth is indicative of potential radiative transfer through sea ice, justifying the need for improved data measurement capabilities. |
| Outcome |
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| **Supervisor Response** |
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| **GA 6: Professional and Technical Communication** |
| **Student** |
| The final year project will be compiled and written up as a final year project report of not more than 70 pages. All sources will be referenced using the Harvard referencing style. The report layout will follow the recommended final year project report guidelines and I will endeavour to ensure that the report is as error free as possible. All figures, tables and illustrations will be appropriate for the content and will be correctly captioned. |
| Plan of development (Chapter headings) |
| Chapter 1: Introduction  Chapter 2: Literature Review Chapter 3: Hardware Design Chapter 4: Firmware Design Chapter 5: Experiment Testing Rig Design and Setup Chapter 6: Experimental Procedure Chapter 7: Results Chapter 8: Discussion Chapter 9: Conclusion Chapter 10: Recommendation for Future Work |
| Detailed Table of Contents |
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| **Supervisor Response** |
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| **GA 8: Individual, Team and Multidisciplinary Working** |
| **Student** |
| This final year project is an individual effort, other than the normal guidance of my supervisor(s). All contributions and assistance from other parties are acknowledged in my report acknowledgements and cited, where appropriate. |
| **Supervisor Response** |
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| **GA 9: Independent Learning Ability** |
| **Student** |
| I acknowledge that the final year project will require me to identify and learn new knowledge and skills based on my topic. I take personal responsibility for these processes. I will attend weekly meetings with my supervisor(s) and set weekly goals for the project. If I am unable to attend a weekly meeting I will provide a brief written update on my progress using MS Teams. I have engaged with the ethical considerations of my research and complied with the EBE ethics process by completing, submitting and receiving approval for my work through the EBE EiR. |
| Project timeline (milestones) |
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| EBE ethics approval reference number |
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| **Supervisor Response** |
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**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 are provided below. Supervisors may then respond to the student's plans and current progress, providing additional comments or advice as they see fit. If the student's progress is sufficient, they may indicate that DP is awarded.

**GA 1: Problem Solving**

Identify, formulate, analyse and solve complex engineering problems creatively and innovatively.

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

Demonstrate competence to plan and conduct investigations and experiments. 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 6: Professional and Technical Communication**

Demonstrate competence to communicate effectively, both orally and in writing, with engineering audiences and the community at large. 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.

**GA 9: Independent Learning Ability**

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