We have designed the wheel according to the following requirements

1. Proper grip and traction to ensure high power transfer
2. Stable base for rover
3. High strength to weight ratio
4. High durability as well as replaceability

To achieve these goals, the following designing parameters were decided, according to given reasons

1. 3d printing using PETG: 3d printing gave us more freedom with the design and allowed us to introduce some innovative characteristics as well as designing procedures into the design itself. This manufacturing method also allowed us to smoothly combine other parts such as the motor mounts. Amongst the available materials, PETG gave the best combination of strength, weight, print quality, cost and handling. Further research is still going on towards material selection to ensure that the wheel is manufactured as optimally as possible.
2. Rubber covering: A commercially available rubber sleeve will be used to cover the outer face of the wheel to increase the coefficient of friction drastically. This ensures that the maximum amount of motor power is transmitted to the ground, allowing for better rover movement, steering and braking. This also protects the inner PETG by prohibiting the PETG from directly coming in contact with the rough ground and providing some damping for minor shocks.
3. Dimensions: Minimizing the weight was a priority, so we have chosen dimensions so that the wheel can function optimally in as low weight as possible. A 22cm diameter allows us space for properly placing the driving motors, ensuring proper use of the torque and increasing speed of rover, all the while fitting inside the given bounding box. 8cm thickness provides the rover with a stable base, even when 1 or 2 wheels have lifted into the air. It also distributes the pressure enough so that the wheel does not have to endure high stresses.
4. Fins: Finlike structures have been added on the outside surface. These have been added to increase the grip of the wheel and provide a place for stress concentrations so that the inner side of the wheel does not bear high stress. The also provide a sort of hook for the rubber sleeve so that it fits better over the 3d printed wheel.

The design of the wheels was done using an iterative process of finite element analysis and topology optimization, using Autodesk Fusion360. A simple design, consisting of the bare details was prepared in fusion and a static analysis was run on that design to test its suitability. If the design had a safety factor of greater than 3, it was run through topology optimization, where the goal was to maximize stiffness and minimize weight. The results of that analysis would be then converted to a solid body and re-entered into the topology optimization. Repeating this process several times, we were able to create a design that is able to fulfil our requirements in the lowest weight possible.