McMaster Solar Car Electrical Team Design Challenge

Please choose **one** of the following options that fit requirements for you. Delete the other questions and put your answer on the docs below the question. When completed, include any supporting documentation that you see fit and send all documents in a **.zip**. These questions are intentionally open-ended and are intended to give you a chance to show off your research and engineering design skills. Detailed schematic drawings aren't what we're looking for, but pencil sketches may help you explain your answer. Attach any drawn or CAD schematics and **export them to a pdf**. Your explanations should also be in a **PDF**. Please limit the length of your submission to **500-750 words**, excluding calculations.

1st, 2nd year Challenge:

Outline the composition and design considerations for solar cells array for an electric vehicle, specifically discussing:

- How solar cells convert solar energy into electricity and the factors that affect the efficiency of this conversion
- Typical performance metrics for a solar cell array (what kind of specifications are we trying to design for?)
- Selection of the type, quantity, and arrangement (series and parallel configuration) of cells
- Circuits required for control and safety of solar cell array, and thoroughly describing what safety concerns may arise.
- **BONUS**: Select an available solar cell in production and use its datasheet values for full calculation of required values to create an array that can produce 28V with 167W peak output.
  BONUS: Create a schematic of a basic solar cell array and any external circuitry needed for safety implementation.

3rd, 4th , Upper year Challenge:

You are given a signal with lots of noise. Design a circuit that will cutoff any frequency higher than 1.87 kHz with a sharp roll-off. You may create alternative voltage sources to power your device.

Design Requirements:

- Cutoff frequency of 1.87 kHz
- Signals are within 10 -15V range
- Indicator lights for demonstrating board status
- Reverse polarity protection on the input side
- Minimize the voltage drop and power draw from your device
- **BONUS: Design a PCB** with your chosen components (preferred EasyEDA)

Use the information above to complete the following:

- Provide either a hand drawn schematic or a schematic file from Altium, Fusion 360, or Easy EDA
- Create a brief report to explain calculations, simulations, design process and choices you have made. Include screenshots or diagrams you see fit
- State assumptions made when designing the schematic/PCB
- Select components capable of operating within the above requirements
- Include and reference any sources used