

High Current Pulse Generator for the Application of Transcranial Magnetic Stimulation

Clients/ Advisors: Priyam Rastogi, Neelam Gaunkar, Jayaprakash Selvaraj, Dr. Mani Mina

Project Objective: Over the course of 2 semesters, design, fabricate, and test a high-current pulse generation device for use in TMS research.

- Objective of Circuit

- Peak Current of 2 kA +10%

- EMF feedback must be considered

- Peak Current Sustained for 400 μ s

- Rise/fall time of 100 μ s

- Up to 36 Hz pulse frequency (Commercial Benchmark)

- Circuit Input is 120 V wall outlet.

- Range of Load - 5 micro-Henry (min) to Max(Undefined)

- 10 pulses a minute max

- Circuit shall be monophasic;

- If successfully completed then a biphasic version shall be built.

- The device shall output multiple waveforms (Square, Sawtooth, Triangle, Sine)

Team Members:

Brian Kirkpatrick: Head of Circuit Design

Jon Rothfus: Head of Micro-Controllers, Team Communications Leader, Webmaster

Tania Alvarado Carias: Head of Electrical Safety

Abdul Bahashawn: Head of Rectification Circuits

Yan Wang: Head of Component Selection

Curtis Richards: Team Leader

Sub Teams:

Chassis Design: Tania, Curtis, Yan

-Meets Thursdays 3:00-5:00 p.m. Durham

Rectification Circuit: Abdul, Yan, Brian

-Meets Thursdays 3:00-5:00 p.m. Durham

Power Circuit: Tania, Curtis, Abdul

-Meets Thursdays 3:00-5:00 p.m. Durham

Micro Controller: Jon, Brian

-Meets Thursdays 3:00-5:00 p.m. Durham

*NOTE: Teams with Brian need to reschedule their times after his schedule is finalized.

Weekly Summary:

- Power Circuit:

- Chassis Design: n/a (Will finish chassis after circuit is tested and complete.)
- Micro-Controller (M.C.): No work directly done on MC this week. Worked with team on IGBT gate driver op-amp circuit and signal pulse generation.
- Precision Electronics:

Accomplishments of the Past Week:

Each member is to write up a reflection on their work throughout the week. The reflections can be found at <https://iastate.app.box.com/folder/46145323949>

Pending Issues:

- I. Due Dates
 - a. Weekly Report to be filled out by Wednesday at midnight
- II. Team Reports
 - a. Update your sub team sections accordingly

New Business:

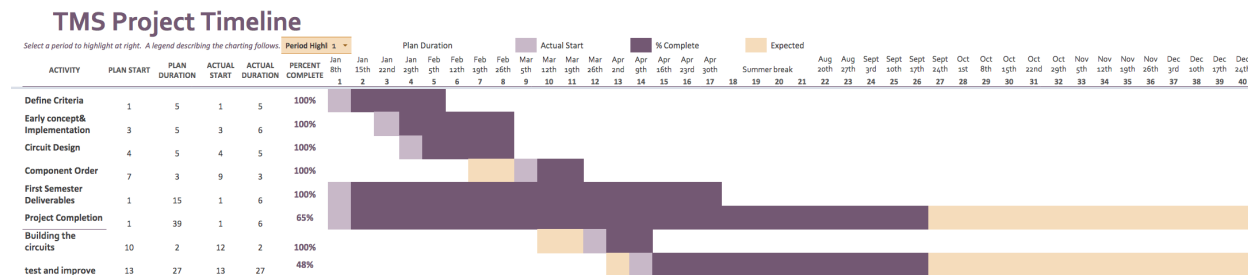
1. Meeting with Neelam and new Grad Students at 4:30 p.m.

Individual Contributions:

Group Member	Accomplishments	Time Worked This Week	Total Time Worked
Abdul	Read about igbt and testing it and watch videos.	3	15
Yan	Updated Gantt chart. Worked on soldering the diodes onto our PCB board and review our circuit to measure how “full” our capacitor got.	4	18.5
Jon	Worked with Chuck and Tania in lab to test IGBT. Worked with Abdul to test pulse amplifier card given to us by advisors from previous senior design team. Found that amplifier card given to us could amplify square pulses, but it inverted them. Other waveforms were not passed by the card. We tried using the signal generator with the	4	22

	<p>amplifier card to control the IGBT gate with minimal success.</p> <p>We created an op-amp configuration instead to boost the signal for the IGBT gate. We tested with the oscilloscope and this seemed to be working until we set our op-amp on fire...sad day.</p>		
Brian	<p>Built the small scale model of the capacitor measuring bank and tested with a 25 volt scale. Soldered some components to the PCB and ordered the remaining components needed for the board.</p>	4	21
Tania	<p>Developed a circuit in series with the coil to be able to measure the voltage and tested the IGBT.</p>	5	18
Chuck	<p>Tested the IGBT, and developed the testing resistors for the output in association with Tania</p>	5	19

Current Progress:+



Individual tasks to be completed before next meeting:

Everyone:

- Weekly reflection
- Senior Design Report
- Chuck find SPICE file for transistor.
- Electronic Measurements Team
 - Measure inductance of test coil
 - Additional Voltage measurement for Capacitors
 - Build Capacitor Charging Indicator Circuit
- Power Team
 - Begin testing using old pulsar
 - Wire in the Relay
- Chassis Team
 - IR Camera
- M.C.

- Work out the bugs for the new amplifier from the micro-controller to IGBT
- Add relay into circuit.
- Investigate built-in IGBT temp sensor and evaluate potential to sense temp with MC
- Test IGBT Signal Output system
- Optimize circuit design and prep for possible PCB layout

Summary of Weekly Advisor Meeting:

The advisor meeting was postponed to next week due to testing problems that took more time than anticipated.