PI TAU SIGMA ANNUAL CHAPTER REPORT
2013-2014
Cooper Union Pi Phi

A. Initiations

For the 2013-2014 academic year, Cooper Union held two initiation ceremonies for Pi Tau Sigma, one in the October, and one in February. The Fall Initiation was held on October 24th, 2013, and a total of 6 new members were inducted- 3 juniors and 3 seniors. The society examined the cumulative GPA's of the inductees. The senior requirement of having a 3.5/4.0 GPA was relaxed to a 3.3/4.0. The junior GPA requirement was relaxed from a 3.7/4.0 to a 3.5/4.0, in order to accommodate the top 10% of the class. The ceremony was initiated by a current Pi Tau Sigma member leading the new inductees into a dimly lit room. The inductees were seated, and took the necessary oaths as delivered by the President and Vice President. All the current members attended the ceremony as well in order to welcome the new inductees, and to also have a club meeting to discuss the agenda for the coming academic year. The ceremony ended with a meal of pasta and garlic knots.

The Spring Induction took place on February 20th, 2014, and a total of 4 juniors were inducted. The Spring Induction was invitation based, and anyone interested in joining the society had to write a short letter describing why they should be admitted. Based on their letters, academic records, and potential for becoming an ethical and effective engineer, four students were chosen. Each student had at least a 3.4/4.0 GPA. The ceremony was very similar to the Fall ceremony, where the new inductees were lead into a dimly lit room. The reason that the Spring Induction took place so early on in the semester was to facilitate the expansion of the club's activities. With more people inducted earlier on, the society can increase the number and extent of the activities it partakes in, especially with respect to STEM outreach. The officers for the succeeding academic year were also elected for each of the 5 positions: President, Vice President, Treasurer, Secretary of Internal Affairs, and Secretary of External Affairs. All the members shared a meal of pasta and garlic knots after the election process.

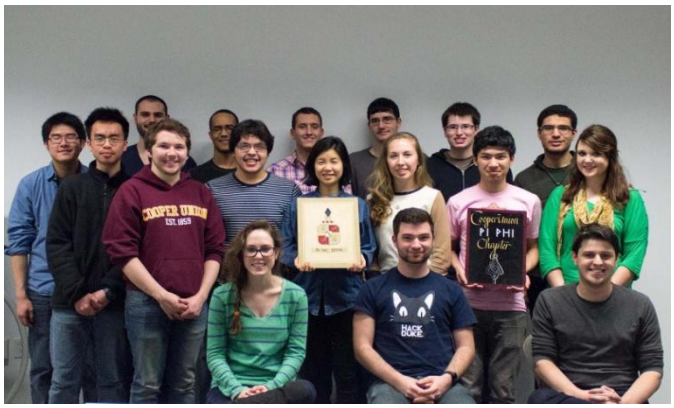

Figure 1: Pi Tau Sigma 2013-2014 Members

B. Chapter Activities

This year, Cooper Union's chapter was quite intent on expanding its STEM outreach efforts. Outreach with the Metropolitan Expeditionary Learning School (MELS) was continued with STEM activities. Cooper Union's Pi Tau Sigma chapter collaborated with the Formula SAE team during these activities. During the winter break, about 120 students from MELS visited Cooper Union over the course of three days. On each day, 40 students rotated between three different breakout sessions- one focused on the four stroke Otto cycle, another involved a tour of the Automotive and Engineering Lab, and the last was an energy lesson and demonstration. During the four-stroke Otto cycle session, students learned about engine components, fuel-air ratios, and how it all comes together in the Otto cycle. The lesson ended with a live demonstration of a single cylinder glass engine that runs on acetone. Seeing actual sparks and combustion happening in the engine, and hearing the difference in sound as the fuel air ratio was adjusted was very exciting for many of the students. During the tour of the Automotive and Experimentation laboratory, students were able to see a real racecar that was designed and built from scratch by Cooper Union students. The importance of materials used for vehicle systems was introduced, in relation to concepts such as weight and its effect on acceleration, and the shape of the body and its effect on aerodynamics. Students were able to study metals such as aluminum and steel, and composite materials such as carbon fiber. For the last session, students learned about advanced energy concepts such as the conservation of energy. Live demos of a pendulum and a mini roller coaster were used to explain the difference between kinetic and potential energy. Students were also able to learn about chemical, mechanical, and electrical energy through a Rube Goldberg machine. It used Sterno to boil water, which turned into steam, which then drove a piston that turned a wheel that ultimately turned a generator connected to a light bulb. Students were also able to learn about the history of Cooper Union and its LEED Platinum New Academic Building with many of its green features, including its air handling units and its cogeneration plant. New York 1 came to interview some of the students involved, and this segment aired on their show "It Ain't Rocket Science," which can be seen here: http://www.cooper.edu/about/news/engineering-students-middle-school-outreach-featured-ny1

Figure 2: MELS at Cooper Union, Engine and Rube Goldberg Demos

During Spring Break, Cooper Union visited the MELS students in Forest Hills, Queens in order to build electric cars with them. The cars were all made up of components such as a wooden chassis, an electric motor, wheels and axles, and a battery pack. Using screws, nuts, wrenches, and screwdrivers, students had to assemble these cars from scratch. Part of the challenge was the fact that there was no instruction manual. After assembling the cars, the students raced them, and timed the cars with different weights on them, noting the effect of weight on trial times. During the second session, the MELS students presented their alternative bus choices for the MTA. These decisions were based on cost, fuel economy, as well as emissions. Cooper Union provided feedback on these presentations, and also asked insightful questions. Pi Tau Sigma was also invited to join MELS during their actual presentation to the MTA, where engineers and financial executives were present. The MELS students did an incredible job of pitching their ideas and suggestions.

Pi Tau Sigma also formed a new relationship with Icahn Charter School in the Bronx. Cooper Union participated in two outreach events with Ichan, one on Cooper Union's campus, and one over at Icahn's campus. During the winter break, Cooper Union aided Ichan students in building electric motors out of plastic cups, wires, batteries, and magnets. Each student group was able to build their own working motor and keep it afterwards. Parents were also invited to the event, so they were able to learn and build motors as well. During the Spring semester, Ichan made a trip over to Cooper Union, where they learned about musical instruments, acoustics, and vibrations. Everyone made a guitar out of a cardboard box, ruler, rubber bands, and screws. Using a tuner application from smart phones, Cooper Union was able to help Icahn tune their guitars in an effort to be able to play songs. Icahn students enjoyed the outreach activities, and wrote lovely thank you notes to Cooper Union in order to show their appreciation.

Figure 3: Cooper Union at Icahn Charter School

In March, Pi Tau Sigma also created a one day introduction to engineering for high school students from Waseda Juku, a prep school in Japan. Cooper Union prepared four modules involving a flash flooding lab experiment, building an electric motor, the four stroke Otto cycle, and a tour of Cooper Union's laboratories and facilities. Two of our volunteers also spoke Japanese, and was able to help out with any translations. The daylong seminar was intended to provide hands-on building experience on top of an introduction to more advanced engineering concepts such as circuits and engine cycles. A total of sixteen students participated in the seminar. One student was so moved by what she was exposed to during the day that she declared that she would be studying industrial design and engineering for college. This was also the first year that Cooper Union worked with Waseda Juku students, and the first year that Cooper Union worked with an international school for STEM outreach.

Aside from STEM outreach, Pi Tau Sigma also collaborated with ASME, ASCE, and Chi Epsilon (the Civil Engineering honor Society) to hold several review sessions for the Fundamentals of Engineering (FE) exam. We had members lead review sessions which were open to students from all majors. Review sessions were typically held with 5 students at a time, and provided a mixture of independent problem solving and concept review in groups. At least four Pi Tau Sigma seniors passed the FE exam this academic year.

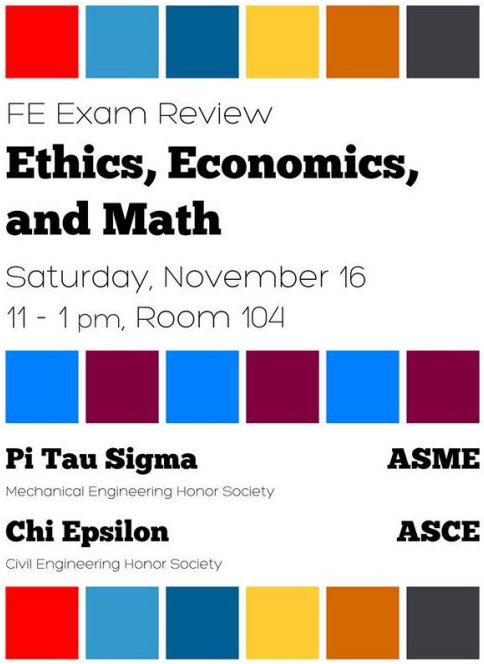

Figure 4: FE Exam Review Session Poster

We have also created a website for our chapter of Pi Tau Sigma in order to better document and display our chapter activities. The website contains information about our chapter, members, and events that we partake in. The link is provided here: **http://pitausigma.cooper.edu/.**