Work in Progress: Assessing the Impact of the First-year Summer Experience Program on Engineering Student Development and Transfer into Engineering

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Paige Smith, Ph.D. is the director of the Women in Engineering Program in the A. James Clark School of Engineering at the University of Maryland. Paige has over 20 years of experience with recruiting and retaining diverse populations in engineering. Under her leadership, the Women in Engineering Program received the 2008 National Engineers Week Introduce a Girl to Engineering Day Award. She is the principal investigator for a National Science Foundation's Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP) grant called the Successful Engineering Education and Development Support (SEEDS) Program. SEEDS extends successful women in engineering retention programs to all first-year and new external transfer students in the Clark School. Paige is the co-lead for the Mid-Atlantic Girls Collaborative (MAGiC), a regional collaborative within the NSF-funded National Girls Collaborative Project which brings together girl-serving organizations across Delaware, Maryland, Virginia, and Washington, D.C. that are committed to increasing the number of young women pursuing science, technology, engineering, and math (STEM) careers. Currently, Paige is serving as the Immediate Past President for the Women in Engineering ProActive Network (WEPAN). Paige earned her Ph.D. and M.S. in industrial and systems engineering and B.S. in engineering science and mechanics from Virginia Tech.

Kurubel Belay, University of Maryland

Work in Progress: Assessing the Impact of the First Year Summer Experience Program on Engineering Student Development and Transfer into Engineering

Abstract: The First Year Summer Experience (FYSE) program is a three-week residential summer orientation program at the University Maryland College Park focused on the development and strengthening of math-intensive engineering problem-solving skills. Recruitment and selection of participants is targeted toward inclusion of women, underrepresented racial/ethnic minorities, first-generation college students, engineering admits with weak mathematics preparation, and students interested in engineering but who were not admitted. From 2012 to 2017, there have been 240 FYSE participants, including 106 students majoring in engineering and 134 students in the Letters & Sciences division. This paper will explore a work in progress in understanding participants' longitudinal progress to transfer into engineering majors and degree completion. This discussion will be supplemented with longitudinal and focus group data to explore the extent to which students were supported by the components of the FYSE program.

It has been well documented in previous research that first-year summer programs are beneficial to the academic, social, and personal development of student participants (Ackermann, 1990; Cabrera, Miner, & Milem, 2013; Garcia, 1991; Walpole, Simmerman, Mack, Mills, Scales, & Albano, 2008). First-year summer programs, also known as summer bridge programs, are particularly beneficial to underrepresented, minoritized students and first-generation college students, who may not have access to the social capital of their majority peers (Ackermann, 1991; Murphy, Gaughan, Hume, & Moore, 2010; Strayhorn, 2011). As many first-year summer programs focus on the transition into college and the campus community, these programs can ease the adjustment to the academic and social aspects of college life, as well as provide the support structures and resources to facilitate student development and student success. This support can be especially relevant for students in STEM fields of study, such as engineering, which are often academically demanding and display greater disparities in representation by gender and by race (Gleason, Boykin, Johnson, Bowen, Whitaker, Micu, & Slappey, 2010; Raines, 2012).

For example, the work of Ackermann (1990; 1991), Cabrera et al. (2013), Garcia (1991), Kezar (2000), Strayhorn (2011) and Walpole et al. (2008) document the impacts of first-year summer bridge programs on students' transition into college. In particular, these scholars note that such programs can positively impact the academic, social, and personal development of underrepresented student populations (Ackermann, 1990; Garcia, 1991; Strayhorn, 2011). In addition to impacting these areas of student development, first-year summer programs can positively influence students self-efficacy and sense of belonging (Cabrera et al., 2013; Stolle-McAllister, 2011; Strayhorn, 2011). Furthermore, longitudinal studies have documented that first-year summer programs can also contribute to the likelihood of student persistence through

the first-year and beyond, and a greater likelihood of being retained through graduation (Ackermann, 1990; 1991; Cabrera et al., 2013; Garcia, 1991; Murphy et al., 2010).

The impact of first-year summer programs can be especially beneficial to underrepresented students pursuing STEM fields of study (Gleason et al., 2010; Raines, 2012; Stolle-McAllister, 2011). The work of Raines (2012) emphasizes that first-year summer programs can not only help to recruit students in STEM majors and better prepare them with a strong foundation for STEM coursework, but also contribute to having a strong impact on student retention. The particular program described by Raines (2012) focused on engaging students in strong mathematics preparation, ensuring that students were prepared in the concepts and skills for the foundational mathematics courses in college. Gleason and colleagues (2010) describe a similar program design to promote the success and retention of students, focusing on engineering students in particular. The summer program examined in their study highlights the engineering-based math content integrated into the program to strengthen students' math preparation for mathematics and engineering coursework and provide them with opportunities to engage in applied engineering problem-solving. Furthermore, the program notes the benefits of the interactive nature of the program, which includes field trips, lab experiences, and hands-on projects, which contributes to students' engagement in the program content (Gleason et al., 2010).

Given the important impact that first-year summer programs can have on the success and retention of students, particularly among underrepresented students in STEM, there is a continued need to implement and evaluate these programs in various university contexts. Evaluation of program effectiveness can help to improve the impact of the individualized program in its context to best serve and reach its students and contribute to better understanding

the role of first-year summer programs at large and further promote implementation in various contexts. The First Year Summer Experience (FYSE) program at the University of Maryland is one such program under evaluation. This paper on a work in progress will provide an overview of the program and the students that it seeks to serve, the methodological approach to program evaluation, and the initial quantitative and qualitative findings that emerged. The paper concludes with a discussion on the findings and offers directions for future research and consideration.

FYSE Program Overview

The First Year Summer Experience (FYSE) program is a three-week residential summer orientation program focused on the development and strengthening of math-intensive engineering problem solving skills. All new students offered admission to the School of Engineering and students who applied to engineering but were instead admitted to the Division of Letters and Sciences (L&S) were invited to participate in the program. Recruitment and selection of participants is geared toward inclusion of women, racial/ethnic minorities, first-generation college students, and engineering admits with relatively weak mathematics preparation. Approximately 40-60 first-year students participate in the program each summer. The participants are required to live in the provided housing for the duration of the three-week program.

The main goal of the FYSE program is to strengthen engineering-related mathematics skills, with particular focus on pre-calculus and the application of engineering problem solving. Each day during the week, the students participate in several classroom and laboratory hours of math-intensive curriculum aligned with practicing and strengthening engineering problem-solving skills (see Appendix A for sample syllabus from 2017). From 2012, the coursework has

been taught by three university faculty members and instructors and assisted by a graduate assistant and undergraduate teaching assistants. In 2017, the course was instructed by two doctoral graduate student instructors, and supported by undergraduate teaching assistants and a senior teaching fellow. Students have daily homework assignments, computer lab work, exams, and an engineering-related group project and final presentation. Upper-level engineering students, hired as tutors, assist students each week night to provide guidance and support on homework assignments and projects.

In addition to the academic components of the FYSE program, the program seeks to cultivate community and a network of support among each FYSE cohort (see Appendix B for sample schedule). Team building is strengthened through various team-building activities, such as a group outdoor challenge-by-choice course, field trips, and recreational activities.

Furthermore, the FYSE program assists in facilitating students' acclimation to the School of Engineering and the university campus. Students participate in a series of seminars featuring faculty researchers in various departments within engineering. During one of these seminars, students have the opportunity to have an open dialogue with the engineering deans. These sessions provide a unique opportunity to students to begin developing a strong network of support, while becoming exposed to various research and extracurricular opportunities offered throughout campus.

Through the FYSE program, students in the Division of Letters and Sciences gain early access to resources and support services within the school of engineering, in addition to the academic support provided directly through the FYSE program. Letters and Science students who successfully complete the FYSE with a grade of B or better, are offered enrollment in the first engineering design course (ENES100) during their first fall semester provided they are co-

registered in calculus I or a higher level calculus course. These support structures help to facilitate L&S students' transfer into the school of engineering. All students in the FYSE program, including those in L&S, are tracked longitudinally to better understand transfer into and progress to and through the engineering degree.

Purpose of the Study

The purpose of this study is to investigate the longitudinal progress of students participating in the FYSE program, focusing on L&S students' transfer into the School of Engineering and engineering students' progress toward degree completion. As a work in progress, we ultimately seek to assess the impact of the FYSE program on engineering student development and their progress toward an engineering degree.

Methodology

From summer 2012 to 2017, there have been 240 FYSE participants, including 106 students majoring in engineering and 134 students in the Letters & Sciences division as reported in Table 1. Ninety-three percent of the FYSE participants successfully completed the program (95% of engineering students and 90% of L&S students). This study provides an examination of each cohort of students' progress into and through the School of Engineering. IRB approval was secured for the 2012-2015 cohorts which are included in this aspect of the study. In particular, we highlight the retention of students each year and the number of L&S students who have successfully transferred into the School of Engineering. Note that longitudinal data for L&S students is not provided for the 2012 cohort due to the small number of L&S students

participating that year. In addition, the longitudinal data only includes students that enrolled in the university in the fall semester immediately following the FYSE.

Table 1. Majors of students participating in the FYSE

Cohort	Major		Total
	Engineering	Letters & Sciences	
2012	37	2	39
2013	16	24	39
2014	9	31	40
2015	17	23	40
2016	16	42	58
2017	11	12	23
Total	106	134	240

In addition to the tracking of longitudinal data, we conducted focus group sessions to assess the impact of the FYSE program on student development and transfer into engineering. Participants were recruited from the 2013 to 2016 cohorts through a recruitment email explaining the purpose of the study. Two focus groups of six participants each were conducted, lasting approximately 75 minutes each. Focus group participants provided their consent for recording the session. Following an introduction, overview of the study, and completion of the IRB consent forms, the focus group facilitator engaged the students in a series of discussion questions and activities, encouraging students to reflect on and share about their experiences in the FYSE program. After the sessions, the recordings were transcribed and reviewed by the researchers. Transcriptions and notes were then coded for emerging themes. This report includes a summary of the qualitative findings from the focus groups, one of which included L&S students (n=6) and another which included students originally admitted into the School of Engineering (n=6).

While additional qualitative data will continue to be collected, this work in progress report will present the longitudinal data, supplemented by the focus group data to provide preliminary findings.

Descriptive Findings from the Longitudinal Study

Longitudinal data through January 2018 was collected for the 2012-2015 cohorts. One hundred and fifty-eight students participated in the FYSE and subsequently enrolled in the university, 68% from underrepresented populations and 43% women. Among the 79 engineering students, 29% are from underrepresented populations and 53% are women; among the L&S students, 34% are from underrepresented populations and 33% are women. Underrepresented populations include African Americans/Blacks, Hispanic Americans, American Indians, Native Hawaiians and Native Pacific Islanders. Sixty-two percent of men that started in engineering were retained or graduated in engineering, while 81% of women that started in engineering were retained or graduated in engineering.

Of the engineering majors that participated, 72% are currently enrolled or graduated (men: 62%; women: 81%) while 11% changed majors and are currently enrolled or graduated in other majors (men: 14%; women: 12%) and 20% left the university (men: 24%; women: 7%), shown in Table 2. Similarly, of the 79 students initially admitted to L&S, 48% transferred into engineering and are currently enrolled or graduated (men: 47%; women: 50%), while 22% transferred into another STEM major (men: 26%; women: 12%), 19% are enrolled in a non-STEM major (men: 17%; women: 15%) and 11% left the university (men: 9%; women: 23%), as shown in Table 3. For the Letters and Sciences students successfully transferring into

engineering, less than 2% left the university without a degree, less than 3% are currently enrolled or graduated in a non-STEM major and less than 4% are currently enrolled or graduated in a non-engineering STEM major.

Table 2. Retention to engineering for FYSE students admitted directly to engineering

Cohort	Currently enrolled or graduated in engineering	Currently enrolled or graduated in non-engineering major	Left the university
2012	75.7%	10.8%	13.5%
2013	75.0%	6.2%	18.8%
2014	55.6%	11.1%	33.3%
2015	70.6%	23.5%	5.9%
Total	72.1%	7.9%	20.0%

Table 3. Retention of L&S students that participated in FYSE

Cohort	Transferred and retained in Engineering	Transferred and retained in another STEM major	Retained in a non-STEM major	Left the university
2013	48%	17%	22%	13%
2014	35%	19%	26%	19%
2015	61%	30%	9%	0%
Total	48%	22%	16%	11%

First semester grade point averages for engineering and L&S students are provided in Table 4. As may be expected, engineering students retained in engineering (mean GPA=3.29; mean GPA_{men}=3.27, mean GPA_{women}=3.30) and L&S students who transferred to and were retained in engineering (mean=3.33; mean GPA_{men}=3.30, mean GPA_{women}=3.40) have higher grade point averages compared to their peers who do not transfer into (mean=2.75; mean GPA_{men}=2.78, mean GPA_{women}=2.71) or remain in engineering (mean=2.61; mean GPA_{men}=2.48, mean GPA_{women}=2.82). One unexpected observation is that Letters and Sciences students seem to have higher first semester grade point averages compared to the engineering students based on cohort averages and average across all cohorts.

Table 4. Comparison of first semester grade point averages for engineering and L&S students

Cohort	Engineering students retain in or graduated from engineering	Engineering students not retained in engineering	L&S students successfully transferred and retained in engineering	L&S students that did not transfer into engineering
2012	3.497	2.798		
2013	3.183	2.460	3.278	2.536
2014	2.748	2.526	3.417	2.876
2015	3.142	2.436	3.307	2.802
Total	3.290	2.605	3.334	2.754

Focus Group Findings

There were several themes that emerged from the focus group findings, that are generally aligned with the components of the FYSE program. These themes include “Diversity and STEM identity,” “Collaboration,” “Building Community/Sense of Belonging,” “Coursework,” and “Affirmation/Confidence.” The following sections will describe the findings within each of the emergent themes.

Diversity & STEM Identity

Participants across both focus groups noted how impressed they were with the diversity of their FYSE cohort. Many students felt that having exposure to many different backgrounds, in terms of social identities and experiences, allowed for them to gain real exposure into the college environment prior to starting classes in the fall semester.

Several participants appreciated the diversity of the program because it combatted notions of a stereotypical STEM identity. In particular, many women and students of color across focus groups noted that they often feel that their identities are not portrayed in popular understandings and depictions of engineering; being a part of FYSE allowed them to see that anyone could become an engineer.

“I think in this day and age, the stereotypical understanding of an engineer has changed a lot because there are so many different personality types, races, genders, etc. I’ve known this for awhile, but FYSE gave me the largest sampling that proved how diverse engineering actually is.”

“FYSE gave us a new perspective of what it means to be engineers. I’ve done previous programs where I’ve seen the full spectrum of engineering types from the kids like us who are social and get their work done to the ones who don’t socialize at all. FYSE let us see all of this and taught me that you can’t judge a book by its cover.”

Collaboration

Nearly all participants across each focus group identified collaboration as one of the most important skills they developed over their time in FYSE. Experiences with the truss project as well as the daily homework assignments allowed participants to practice working with others and identify their own needs within a team setting. Participants noted that group work and collaboration was a significant part of their educational engineering experience in FYSE. They found that it was beneficial to begin acclimating to collaboration and team building in the engineering context prior to their first semester of coursework.

“Collaboration was a big thing. Working with a group over time on one project and getting to know them and everyone coming up with a stable idea and having to agree was a great part of FYSE. That really carried over to working on projects for ENES 100.”

Building Community/Sense of Belonging

Many participants discussed the significance of building a community outside of the classroom. Living together for the duration of FYSE allowed for relationships to build, many of which are still maintained. Several participants noted that FYSE is where they met future roommates, study partners, and friends. For many students, this aspect of community building allowed them to more seamlessly transition into a large university campus setting with a greater sense of belonging and a community of support.

“I don’t know how they did it but the diversity they pulled in was incredible. Even where people were from and the different types of people we had. We were all going into engineering but all had so many different backgrounds... Everyone found their niche and you felt like you belonged. No one felt like an outsider.”

“...when school started I was surprised how useful FYSE was for me. Going into a class with hundreds of people and knowing 30 people helped out a lot. I already had a group of friends coming in from high school but we weren’t as intensely close as my FYSE peers because of how much time we spent together.”

“FYSE gave me the opportunity to build a friend group before I even started college. I have older siblings who struggled in college to make friends so that was something I was nervous about, especially as an out of state student.”

“I think what was most meaningful to me would also be the bonds formed in that one group. We were never forced to be friends but by virtue of sharing the same experience and struggles, I got to bond with people with different levels of experience and backgrounds. It gave me a lot of confidence my first semesters because I never felt completely alone or intimidated.”

Coursework

Participants who were originally admitted into the School of Engineering noted how much they appreciated the coursework and the academic components of FYSE. A few participants acknowledged that they had a need to improve their science and math skills. All focus group participants noted that while the workload was intensive and thorough, they were highly appreciative of the skills they developed during FYSE, which allowed them to begin their first year of coursework well-prepared.

“...it’s okay to need help, it’s okay to mess up and make mistakes. Engineering is hard and for someone who’s never faced struggle like that before, that’s a difficult transition and FYSE really got the ball rolling on that lesson.”

Affirmation and Confidence

The L&S students who were initially not admitted into engineering, but eventually transferred from L&S into engineering, found that their experiences in FYSE helped them to feel more confident and affirmed. Some participants shared that they felt a sense of shame and self-doubt because they were not directly admitted into engineering. These feelings of shame and

self-doubt made them question whether they were capable of becoming an engineer. Through their FYSE experiences, they learned that they *were* capable and that they could offer value to the program. Several students mentioned that FYSE helped them to build confidence, which they carried into their first year of coursework.

“I came into [this university] not as a direct accept into the engineering school which frustrated me and made me doubt myself. Being a part of FYSE and doing well in it validated that I was supposed to be doing engineering.”

Discussion

The findings of this study suggests that the FYSE program prepares students for their first year of college and contributes to students’ progression and persistence through the engineering degree. The program has been designed to work with students that lack mathematics preparation based on math SAT scores and math coursework and grades) and those who were not directly admitted into engineering. Over seventy percent of the engineering students FYSE students have been retained or graduated in engineering, while 48% of L&S FYSE students successfully transferred and have been retained in engineering. After engineering, Letters and Sciences students most frequently transferred into computer science (10%), economics (6%), biological science (4%), and environmental sciences (4%).

As the findings of the qualitative portion of the study suggest, students attribute the FYSE program to helping them feel better prepared academically for their coursework, as well as in their general social transition into college life and future collaboration with peers and classmates. In general, many students appreciated the community aspect of the FYSE program, articulating the contribution of this aspect to their success in their first year. Furthermore, students expressed appreciation of the value of diversity among the FYSE cohort, emphasizing

that diversity in the program helped them to recognize the changing landscape of STEM fields and the value that diverse identities bring to the field of engineering. For L&S students in particular, the community and diversity aspects also contributed to building of student confidence and affirmation in their decision to pursue and continuing pursuing engineering as a field of study.

Future Directions

As a work in progress, this study will continue to explore the extent to which students were supported by the components of the FYSE program. We will continue to track each cohort of the FYSE program to assess their longitudinal progress toward degree completion. Future analyses of data will include survey data from FYSE participants. We are also interested in examining students that transferred into the computer science major, as this is one of the common pathways for students who do not remain in engineering.

Particularly among L&S students who successfully transferred into engineering, we aim to better understand the supports and services that these students took advantage of, and the ways in which these supports contributed to their success. We believe conducting additional focus groups could help us to address this objective, in addition to better understanding student development experienced during and after the FYSE program. Furthermore, additional investigation may allow us to evaluate students' readiness across academic, social, and career measures.

While we were able to conduct focus groups for students who were in engineering and those who successfully transferred into engineering from L&S, future research will include focus group data from students who left engineering or never successfully transferred into engineering. Though this is a more challenging group to track down, we believe the insight from these

students will be valuable in better our understanding of the strengths and weaknesses of the FYSE program.

For engineering schools or engineering programs seeking to implement first-year summer programs, we believe it is important to consider the needs of the populations that the potential program hopes to serve. It is challenging, but important, to be intentional about the design components of the program to best meet the needs of the target student population and engage students as much as possible in an iterative design and re-design process. Program coordinators/directors should be mindful and cognizant of the best ways in which to support the students in the summer program in their academic, social, and personal development, while understanding that each student is unique in his/her developmental process and entering the program with various identities and lived experiences. Furthermore, it is critical to be proactive and intentional about ongoing program evaluation and assessment, as well as tracking of students progress, in order to properly evaluate the impact of the program. Program coordinators/directors may want to consider implementing various forms of evaluation, including both quantitative and qualitative approaches, to gain a more holistic understanding of program impact.

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Appendix A: Course Syllabus

Meetings:

- § Mon – Fri, 9:00 – 12:00, CHE 2136 (lecture)
- § Mon – Thurs, 1:30 – 4:30, CHE 2136 (group problem solving session)
- § Mon – Thurs, 4:30 – 5:30, CHE 2136 (group project)
- § Tuesdays and Thursdays, 12:00 – 1:30, CHE 2136 (special lunch presentations)
- § Exception for Tuesday 7/11: lunch will be held in Kim Building Kay Boardrooms

Prerequisites

All students in this course should have completed freshman orientation and must have taken the math placement exam.

Topics Covered

Engineering applications of elementary functions and graphs, including polynomials and rational, exponential, logarithmic, and trigonometric functions. Algebraic techniques preparation for calculus. An introduction to calculus. Engineering problem solving techniques. Preparation for MATH 140 (Calculus I).

Credits

This program does not award credit and it will not appear on your university transcript.

Incentives

- § Improved math and engineering skills.
- § Eligibility for a third attempt at the math placement exam.
- § Complimentary room and board.

Textbook

Stewart, Redlin, and Watson, *Precalculus: Mathematics for Calculus*, 6th Ed., 2012, Cengage, 749 pp., \$158. Books will be loaned free of charge and must be returned in good condition to receive a grade.

Calculators

Calculators may be used for homework assignments, and may only be used on quizzes and exams when specified. *Minimum*: A scientific calculator (about \$20). *Highly Recommended*: A graphing calculator, such as TI-89 (about \$130).

Grading

<i>Participation:</i>	5%
<i>Homework:</i>	15%
<i>Quizzes:</i>	45%
<i>Final Exam:</i>	20%
<i>Group Project:</i>	15%

Homework. Homework will be assigned each Mon – Thurs and will be due at 9:00 am the following day.

Quizzes. There will be a short quiz at 9:00 am most days. Problems will be similar to previous homework problems. In computing your final quiz grade, your lowest quiz grade will be dropped to compensate for days when you are unable to attend class. **No make-up quizzes will be given.** Quizzes will be closed book with no calculators unless otherwise stated.

Final Exam. There will be a final exam on the last day. This will be closed book except for one page of notes.

Project. The project will be a team activity that emphasizes creative engineering design using pre- calculus math skills. This will culminate in a design competition.

Academic Integrity

The University's Code of Academic Integrity will be fully enforced and can be found at [website].

Program Evaluation

You will be invited to submit an evaluation of the program on the last day. Your feedback is important and all responses are confidential.

Schedule of Topics

		Morning	Afternoon
Week	Day		
1	Mon 7/10	Course introduction	Introduction to
		2.1 What is a function?	engineering modeling
		Significant figures/units	
		1.5 Equations	
		1.7 Inequalities	
	Tues 7/11	2.2 Graphs of functions	Project introduction

		2.4 Average Rate of Change	Trusses and design
		3.1 Quadratic functions and models	
	Wed 7/12	3.2 Polynomial functions and their graphs	
		2.5 Transformations of functions	
		2.6 Combining functions	
	Thurs 7/13	3.7 Rational functions	Prototype presentations
		Beams in bending (Macaulay functions)	
	Fri 7/14	4.1 Exponential Functions	Off-campus field trip
		4.3 Logarithmic functions	Eaton Aerospace
		4.4 Laws of logarithms	
Week 2	Mon 7/17	4.5 Exponential and logarithmic equations	Trusses and design
		6.1 Angle measure	
		6.2 Trigonometry of right angles	
	Tues 7/18	6.3 Trigonometric functions of angles	
		5.1 The unit circle	
	Wed 7/19	5.2 Trigonometric functions of real numbers	
		5.3 Graphs of sinusoids	
	Thurs	5.6 Modeling harmonic motion	Prototype presentations

7/20

5.4 More trigonometric graphs

	Fri 7/21	Essential trigonometric identities	Off-campus field trip
		7.5 Trigonometric equations	NASA Goddard
Week 3	Mon 7/24	Scavenger hunt	Trusses and design
	Tues 7/25	Limits	
		2.4 Average rate of change review	
		Limit definition of the derivative	
		Derivative rules	
	Wed 7/26	Anti-Derivatives	
		Calculus applications	
	Thurs 7/27	Integrals	Math placement exam
		Numerical integration	Truss testing
	Fri 7/28	Final exam and course evaluation	Farewell event

Problem solution format

Each homework problem submission should have the following components.

- 1) *Basic format.* Please include your name on the top right of the first page. Each problem should be started on a clean side of paper (double sided is OK). All pages should be stapled. Work should be neat and easily legible. We reserve the option to return work ungraded if it does not meet these basic requirements.
- 2) *Problem statement.* A concise (re)statement of the problem should be given. It is not necessary to restate the problem question verbatim from the text, but enough

detail is needed to define the problem, make clear what quantities are given, and what is being sought for the solution.

- 3) *Assumptions.* If any additional assumptions (not stated in the problem) are needed, they should be clearly stated.
- 4) *Diagrams.* A diagram indicating the coordinate axes should be given, and equations should be applied consistently using the convention indicated in your diagram. All symbols need to be defined, including those given as initial conditions in the problem statement or new ones that are needed for the problem solution. A free body diagram will be included when appropriate. You may need more than a single figure for more complicated problems.
- 5) *Algebraic solution.* Start by stating the general equations you plan to use for the solution, which should also clearly relate to your stated known and unknown variables listed from your problem statement and diagrams. An algebraic solution of the problem (i.e. in symbolic format, no numbers plugged in) should be given whenever possible, with enough steps provided for someone to logically follow your work. Numbers should be plugged in to the algebraic solution at the end with appropriate units.
- 6) *Numerical answer.* After substituting the numerical values into the algebraic solution, you should calculate and state the final numerical answer. Appropriate significant figures should be used (e.g. if your given variables only have 3 significant digits, your final solution should not have more than that). Your calculator can probably give you 14 significant digits when dividing irrational numbers, but this does not mean you have the appropriate precision to report that many. The final answer should be boxed so that they can easily be identified.
- 7) *Final units.* You should include correct units on the final answer. This should follow consistently from your algebraic solution, and not simply appear with the final answer because you know what the units “should” be.

Appendix B: Sample Schedule for FYSE 2017

FYSE 2017 Weekly Schedule

Sunday, July 9th

2:30PM – 4:00PM : Check-In

Roommate Assignments, Welcome Folder, Completed Paperwork Check

4:30PM – 5:00PM : Welcome Program

Introduction of Staff, Overview of Program, Dismiss

5:15PM – 6:30PM Dinner & Introductory Activities

Dinner, Activities with RAs, House Meeting

Monday -Thursday, July 10th- 13th

9:00AM – 5:25PM : School day - see tentative schedule for hourly details

5:45PM : Dinner

7:00PM : Tutoring

Tuesday, July 11th 12:00pm: Lunch seminar session with Dean & Associate Dean of Engineering

Thursday, July 13th 12:00pm: Lunch seminar session with Professor of Civil and Environmental Engineering and Advisor of Engineers Without Borders

Friday, July 14th

9:00AM – 1:00PM : Study Session/Quiz/Problem Session/ Lunch

1:00PM – 4:30PM : Field trip to Eaton Aerospace

Vans depart promptly at 1:15PM

6:00PM : BBQ with LSAMP

Activities with RAs

Saturday, July 15th

Tentative Balloon Launch with NearSpace Program (if weather does not permit, this will be on Sunday, July 16th, Saturday, July 22nd or Sunday, July 23rd)

Sunday, July 16th

FREE DAY

Optional activities planned by/with RAs

Monday-Thursday, July 17th-20th

9:00AM – 5:25PM : School day - see tentative schedule for hourly details

5:45PM : Dinner

7:00PM : Tutoring

Tuesday, July 18th 12:00pm: Lunch seminar session with Professor of Electrical & Computer Engineering

Thursday, July 20th 12:00pm: Lunch seminar session with student research panel

Friday, July 21st**9:00AM – 12:00PM** : Study Session/Quiz/Problem Session/ Lunch**12:00PM – 4:30PM** : Field trip to NASA Goddard*Vans depart promptly at 12:15PM***Saturday, July 22nd***FREE DAY**Optional trip to Air and Space Museum, Downtown Washington, DC, planned by RAs***Sunday, July 23rd***FREE DAY**Optional activities planned by/with RAs***Monday-Thursday, July 24th-27th****9:00AM – 5:25PM** : School day - see tentative schedule for hourly details**5:45PM** : Dinner**7:00PM** : Tutoring**Tuesday, July 25th** 12:00pm : Lunch seminar session with Professor of Aerospace Engineering**Thursday, July 27th** 12:00pm : Lunch seminar session with Fire Protection Engineering**Friday, July 28th****9:00AM** : Final Examinations - see instructors for details**1:00PM** : Project Poster Presentation and Closing Reception**2:30PM** : Students depart

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