

Engineering Math Summer Boot Camp to help Students Succeed in Remedial Courses

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Abstract - All incoming freshmen at New Jersey Institute of Technology (NJIT) are required to take math placement test. Based on results of this test, students are placed in calculus-I or one of the two pre-calculus (remedial) math courses. In order to help the student population placed into pre-calculus courses to catch up and start on the right track in their first official semester, NJIT has decided to run a pilot summer boot camp around remedial engineering math courses. Summer boot will offer one section each of the two pre-calculus courses, supplemental instruction, tutoring, and programming to compliment the remedial math courses. The summer boot camp will not only help the students to improve their skills in math but also a variety of perks including: meeting other new students, making friends and study partners, connecting with faculty, finding their way around the campus, and discovering academic resources on campus.

Index Terms – Summer boot camp, pre-calculus courses, supplemental instruction, tutoring and peer mentoring.

INTRODUCTION

Boot-camps are offered by many universities in a variety of fields like STEM, English, and critical thinking. Boot-camps are designed to help students to be ready for rigors of university level academic courses. The main purpose of these boot-camps is to get students acquainted with college learning styles, research opportunities, and diversity. The instructional focus of some universities like Columbia University offering math boot camp is introduction of core concepts like modern mathematics. Similarly, Rutgers University's "Bridge to Success" program is an opportunity for students to get a head start on their college careers. "Low success rates and high costs are driving more states and institutions to seek new ways to offer developmental or remedial college courses." [1] A math boot camp at Harrisburg Area Community College (HACC) has given students a chance at bypassing some developmental mathematics courses. According to Jason Rosenberry, Associate Professor of Mathematics at Harrisburg Area Community College – "Trying to shorten that path through the developmental sequence is really big at the moment." [2]

A significant number of engineering students at NJIT are placed into pre-calculus courses based on their performance in the math placement test. NJIT's Math summer boot camp is designed to fit the academic needs of all students placed in these courses and to get them prepared for next level math courses. The boot camp is specifically designed to prepare students for the calculus classes that they will need to take during their freshman year and to lay the foundation of mathematics and calculus for their engineering careers.

Calculus-I serves as pre-requisite or co-requisite for most of other general university requirement courses as well as engineering courses. It is therefore very important for students to pass the remedial courses that they are placed in and move to calculus-I as quickly as possible. This boot camp promises to be very beneficial in improving their mathematics skills and develop a deeper understanding of the engineering math courses.

During summer time for the last few years, NJIT offered pre-calculus sequence courses for first time full time freshmen. In Summer 2014, a total of 37 students opted to enroll in these 2 courses. Both courses are offered in Summer session II (about 6 weeks). Number of students that are placed in remedial math courses is much higher than 37 and the summer boot camp is intended to attract more students to be proactive and take these courses ahead of their first official semester at NJIT. The summer boot camp can potentially appeal to and get several of these students started early on the right track. Supplementary instruction and additional programming offered as part of this boot camp will help students with time management and study skills and ultimately to succeed at NJIT. The boot-camp will also offer faculty/staff interaction and introduction to a variety of campus resources that will help students to transition smoothly to college life.

BACKGROUND RESEARCH

To come up with the model most suited for NJIT students, a review of several summer boot camps offered by STEM and non-STEM universities and colleges in the US was done. A summary of this background research and review is presented in table 1 below. The idea of summer boot camp is very popular and has been quite successful in getting students a jump-start. NJIT's Educational Opportunity

Program runs a boot camp every summer for all freshmen admitted through their program. It has also been very successful every year in getting these students acclimated to college life and onto the right track. NJIT's engineering math summer boot camp was designed by adopting the best practices from various boot camps reviewed that are most likely to work at NJIT.

TABLE I
SUMMER BOOT CAMPS FOR ENTERING FRESHMAN [3] – [15]

Institute (Duration of the camp)	Instructional Focus	Selection Criteria
University of Texas, Brownsville <i>Summer Math Boot Camps</i> (2 weeks)	• College Algebra • Pre-Calculus	All registered UTB students but limited to 50 students per session
Purdue University <i>STEM Academic Boot Camp</i>	• Adjusting to the social and cultural differences • Helping them understand the differences in the way academic courses are taught at the university level, college learning styles, classroom size and ethnic mix • Experimenting with lab equipment at a university and applying textbook concepts to academic problems • Core concepts of college algebra, calculus, trigonometry, chemistry, engineering and English, along with discipline-specific courses • Cross-disciplinary scientific experiments on a remote-controlled on-road car	• Students that meet or exceed Purdue's aggressive entrance criteria • Any first-year Purdue student in a science related discipline is invited to participate
George Mason University <i>STEM Boot Camp</i> (1 week)	• Calculus I • Cell Biology • General Chemistry • Introduction to Physics • Mentor tutoring: Awareness of undergraduate research opportunities	Incoming freshmen
University of North Carolina, Charlotte (1 week)	• Differential Calculus • Algebraic problem solving • Critical thinking skills	Incoming freshmen
University of West Georgia (4 weeks)	• Math course: College algebra • English course: Developing proficient college-level reading and writing skills	Limited to 40 incoming students

University of Illinois, Chicago <i>Summer Enrichment Mathematics Workshop</i> (5 weeks)	• Elementary Mathematics • Intermediate Algebra	Eligibility is based on UIC Placement Test results, or if you have an ACT Math sub-score of 22 or less
Institute (Duration of the camp)	Instructional Focus	Selection Criteria
Columbia University <i>Math Boot Camp</i> (2 weeks)	Modern Mathematics (differential geometry, differential equations, chaos and fractals, and computational geometry)	Selected on the basis of their aptitude for mathematics
Boston College (6 weeks)	• Advanced Mathematics (topology, projective geometry, transformation geometry, computational geometry, chaos, and coding) • Linear Algebra	• Limited to 80-100 students • Completion of pre-calculus level work and a teacher recommendation from a Math department teacher at their school
Rutgers University <i>Summer Bridge to Success</i> (5 weeks)	Pre-Calculus or Calculus academic tracks depending on their score	Students must receive a math placement score at the Pre-Calculus or Calculus level
University of Wisconsin, Milwaukee <i>Panther Math Prep</i> (4 week on-campus or 6 week online session)	• Higher level math concepts • Placement test preparation	Limited to 32 students per class
Tennessee State University <i>Academic Boot Camp</i> (4 weeks)	• Computer technology training • Quality instruction • Individualized tutoring	Incoming freshmen
University of Maryland (5 weeks)	• Mathematics (Algebra, Pre-Calculus & Calculus) • Success Seminars • Science Engineering Lab • Peer-Led Training	Limited to 20 minority students per year
University of Memphis (2 weeks)	• Pre-Calculus • Links to Science & Engineering • STEM Careers	Entering freshman, but not all. No criteria for selection given

Bowling Green State (5 weeks)	• Mathematics (Algebra, Trigonometry, Geometry, & Calculus) • Computer Science • Science Exposures • Corporate Visits	Entering freshman, but not all. No criteria for selection given
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ENGINEERING MATH SUMMER BOOT CAMP MODEL AT NJIT

Engineering Math Summer Boot Camp at NJIT is designed around pre-calculus sequence. The boot camp is intended for the first year STEM/Engineering students that are placed into either of 4-credit pre-calculus courses. The following two courses will be offered to students under this Boot camp:

- MATH-108: University Mathematics I
- MATH-110: Trigonometry and Differential Calculus

Summer boot camp is a 6-week program offered in summer session II running from 7/6/2015 until 8/14/2015; Monday through Friday from 9:00 AM to 3:00 PM.

TABLE II
PROPOSED SCHEDULE

Courses	Breakfast	Session 1	Lunch	Session 2	Tutoring
MATH-108 and MATH-110	9:00 - 10:00 AM	10:00 - 11:30 AM	11:30 AM - 12:30 PM	12:30 PM - 2:00 pm	2:00 PM - 3:00 PM

PROGRAM BENEFITS

This educational 6-week program is designed to help students get ahead and prepare for their first semester at NJIT. The first year Engineering Science students who are enrolled for this will get 15% off the price of summer tuition.

The main advantages of our Summer boot camp are:

- Enrollment in a 4-credit pre-calculus course (Math 108 or Math 110)
- Breakfast & Lunch served daily
- Social & Educational Activities
- Guest Speakers
- Tutoring from our Peer Mentors
- Field visits

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