

**Associate of Science
Physics and Pre-Engineering
Program Review 2018**

Program Instructors

Dr. Luka Kapkiai

Mr. Nathan Stanley

Mr. Paul Walcher

Introduction

The Associate of Science with emphasis in Physics and Pre-Engineering is a two-year degree track for students who intend to transfer to a four-year college or university and major in Physics and Engineering programs.

Section 1

Current mission statement of the program

The Associate of Science degree in Physics and Pre-Engineering upholds all the missions and purposes of Neosho County Community College (NCCC). Specific missions for the Physics and Pre-Engineering programs are as follows:

1. Provide firm foundations of scientific methods to our students by helping them understand the basic principles of physics and engineering required when they transfer to four-year colleges or universities.
2. Provide all students with the opportunity to acquire knowledge and skills necessary for lifelong learning process as we as creating an enabling environment for our students to think critically, use logic and reasoning to solving everyday problems.
3. Create and develop interest among our students for science courses especially in Physics, Engineering and Mathematics among science majors by engaging students in active learning process.
4. Offer an opportunity of courses in Physics, Engineering, and Mathematics for all our students at NCCC.
5. Involving our instructors in advising our students on their educational goals especially those in science of the many opportunities available in four-year institutions and in the workforce.

NCCC Purpose 1: Student learning through

- the meeting of students' needs,
- quality educational programs, and
- effective assessment processes;

Students desiring to pursue an associate of science degree in Physics and Pre-Engineering program at NCCC are required to take all the courses listed in section 2 under program courses. Each course offered in this program is assessed every semester that the course is offered and in line with the assessment processes established at NCCC. The assessment process is adapted from the guidelines outlined for assessing courses at NCCC.

NCCC Purpose 2: Student success through

- providing personal attention,
- individualized advising, and
- the opportunity to meet student personal goals;

Our class sizes for all the courses in this program are small and thus the instructors and students get to be familiar with each other at a professional level. Due to our small class sizes, instructors can offer one-on-one advising which helps students make better decisions to meet their educational goals that can guide their future professional careers.

NCCC Purpose 3: Ensuring access through

- affordability,
- flexible course delivery and scheduling methods,
- responsive student services, and
- safe and comprehensive facilities;

The courses offered under Physics and Pre-Engineering program are always scheduled and in accordance with the course rotation schedule. This enables our students to know what courses are offered each semester and our instructors are always willing to help advise our students of the courses being offered.

NCCC Purpose 4: Responsiveness to our stakeholders through

- open communication,
- ethical management of resources, and
- accountability

Physics and Pre-Engineering program instructors at NCCC communicate about the needs, changes, progress, and even weakness that the program is facing. All the resources available for use in the program are used accordingly and a record of supplies such as laboratory apparatus is kept for accountability.

NCCC Purpose 5: Meeting community needs through

- collaboration and innovation,
- lifelong learning opportunities,
- cultural enrichment, and
- the providing of an educated workforce.

In the last two years, the Physical Science department (Chanute Campus) has developed a relationship with Wolf Creek Power plant. Students in Chemistry and Physics get the opportunity to visit the plant and learn about generation of electricity using nuclear materials. This has enabled some students to see what areas in the science they can pursue if interested. The opportunity to visit the plant has been beneficial to our students who get to know what goes on in their surroundings. We are however, still exploring ways of forging more collaboration with other local industries or companies to offer internships or training opportunities to our students to gain some experience.

Section 2

Curriculum of Program and Outcomes Assessment

For a student at NCCC to earn an associate of Science degree with an emphasis in Physics and Pre-Engineering program, he or she must take a certain number of courses. Presented below is the Physics and Pre-Engineering program sheet that shows the courses required as well as the core courses in the program.

Physics and Pre-Engineering Program Sheet

Physics and Pre-Engineering

Associate of Science

The Associate of Science with an emphasis in Physics and Pre-Engineering is a two-year degree for students who intend to transfer to a four-year university and major in engineering and physics.

Prerequisites

The student will need to demonstrate proficiencies in reading, English, and mathematics based on the college assessment test, ACT or SAT scores, or by taking the recommended/ required classes. Some of the courses in this curriculum have specific prerequisites.

General Education (GE) Courses

In order to graduate with a college degree, all students are required to take certain general education courses. These include English composition, speech, wellness, science, art and humanities, mathematics, computer systems, and social and behavioral science.

Program Core Courses

MATH 150 Analytic Geometry and Calculus I, MATH 155 Analytic Geometry and Calculus II, MATH 253 Analytic Geometry and Calculus III, MATH 255 Differential Equations, PHYS 104/140 Engineering Physics I/Lab, PHYS 105/145 Engineering Physics II/Lab.

Program Elective Courses

Students interested in biochemistry should take BIOL 251/252 Biology I Lecture/Lab, BIOL 255/256 Biology II Lecture/Lab.

Program Outcomes

Students will develop an understanding of the following:

1. Show concept knowledge in measuring, mechanics of motion, the mechanical and thermal properties of matter, by application in problem solving.
2. Show concept knowledge in waves, simple harmonic motion, Electricity, magnetism, and optics, by application in problem solving.
3. Formulate problems in physics using the tools of mathematics.
4. Incorporation of graphing calculators in math and physics lab analysis.
5. Calculation in three-dimensional coordinate systems.
6. Apply the scientific method in lab work settings.
7. Analyze experimental error in lab work, and relate it to lab measurement.

Course Sequence

The listing that follows is a recommended sequence of courses for full-time students. The student should consult with an advisor for information specific to their academic situation.

Recommended Sequence of Courses

(Fall) Semester I		Cr Hrs
COMM 207	Fundamentals of Speech	3
PSYC 100	First Year Seminar	1
ENGL 101	English Composition I	3
MATH 150	Analytic Geometry and Calculus I*	5
CSIS 100	Computer Concepts and Applications	3
Total		15

(Spring) Semester II		
ENGL 289	English Composition II	3
MATH 155	Analytic Geometry and Calculus II	5
PSYC 155	General Psychology	3
	Arts/Humanities Elective	3
	Social/Behavioral Science Elective	3
Total		17

(Fall) Semester III		
PHYS 104	Engineering Physics I	4
PHYS 140	Engineering Physics I Lab	1
MATH 253	Analytic Geometry and Calculus III	3
HPER 150	Lifetime Fitness	1
	Arts/Humanities Elective	3
	Biological Science and Lab	5
Total		17

(Spring) Semester IV		
PHYS 105	Engineering Physics II	4
PHYS 145	Engineering Physics II Lab	1
MATH 255	Differential Equations	3
	Social/Behavioral Science Elective	3
	Arts/Humanities Elective	3
	Program Elective (s)	3-5
Total		17-19

Total Program Credits **66-68**

*Assuming the student has passed the equivalent of College Algebra and Trigonometry. If not, enroll first in MATH 125 College Algebra and Trigonometry (5 cr hrs).

For more information contact:

Program advisor
Luka Kapkiai, 620-432-0360
lkapkiai@neosho.edu

Core Courses in Physics and Pre-Engineering Program

The following are core courses in the program

- MATH 122 – Plane Trigonometry
- MATH 150 – Analytic Geometry and Calculus I
- MATH 155 – Analytic Geometry and Calculus II
- MATH 253 – Analytic Geometry and Calculus III
- PHYS 104 – Engineering Physics I
- PHYS 105 – Engineering Physics II
- PHYS 140 – Engineering Physics I lab
- PHYS 145 – Engineering Physics II Lab

Program Outcomes

The Physics and Pre-Engineering program have 7 program outcomes that were assessed this program review period. The program outcomes are

Upon completion of this ‘program’ learners should be able to:

1. Show concept knowledge in measuring, mechanics of motion, the mechanical and thermal properties of matter, by application in problem solving.
2. Show concept knowledge in waves, simple harmonic motion, Electricity, magnetism, and optics, by application in problem solving.
3. Formulate problems in physics using the tools of mathematics.
4. Incorporation of graphing calculators in math and the use of logger pro in physics lab analysis.
5. Calculation in three-dimensional coordinate systems.
6. Apply the scientific method in lab work settings.
7. Analyze experimental error in lab work, and relate it to lab measurement.

Assessment Methods for the courses in the Program

The courses offered in the associate of science in Physics and Pre-Engineering program are assessed every semester the courses are offered. Each course is assessed on its specific course outcomes and the program outcomes are assembled based on the individual course outcomes. Several methods are used in course assessment including lab activities, homework, quizzes, collaborative group work, and exams.

Program Outcomes and Program Matrix

Program matrix indicates which individual course outcomes feeds into certain program outcomes. Since the last program review, course outcomes of certain courses have been updated because of Kansas Core Outcomes Groups (KCOG) meetings and that has led to the program matrix being updated. Below is the program matrix for Physics and Pre-Engineering program.

Program Matrix

Course Number	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
MATH 122	Plane Trigonometry			CO 3-9	CO 1-11			
MATH 150	Analytic Geometry & Calculus I			CO 3-5	CO 1-5			

MATH 155	Analytic Geometry & Calculus II			CO 1-5	CO 1-5	CO 1		
MATH 253	Analytic Geometry & Calculus III			CO 1-5	CO 1-5	CO 1-5		
PHYS 104	Engineering Physics I	CO 1		CO 2, 3				
PHYS 105	Engineering Physics II		CO 1	CO 2, 3				
PHYS 140	Engineering Physics I Lab				CO 4		CO 4	CO 4
PHYS 145	Engineering Physics II Lab				CO 4		CO 4	CO 4

Program Outcomes Grand Totals

Academic Year	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	Weighted Average
13-14	0	0	77	77	68	0	0	77
14-15	82	0	76	76	94	0	0	76
15-16	81	75	78	78	0	0	0	78
16-17	72	88	73	74	73	0	0	74

Courses in the program have a set goal of 70 %. The weighted averages recorded here were relatively the same as for the previous program review of 2012. There were zeros recorded and this could have been due to some errors on the course outcomes scores pulled from courses that were never taught.

Course Level Analysis

All the courses under this program are assessed based on the specific course outcomes. Below are course outcomes that were recorded for the individual core courses in the program.

Plane Trigonometry (MATH 122) and Analytic Geometry and Calculus I

Course Outcome	MATH 122					MATH 150			
	13-14	14-15	15-16	16-17		13-14	14-15	15-16	16-17
1	85	85	85	85		70	75	84	73
2	86	86	85	91		80	69	75	71
3	87	87	79	83		77	75	87	84
4	85	80	78	91		68	65	76	64
5	61	79	77	82		77	71	76	70
6	76	88	75	83					
7	82	76	77	88					
8	80	90	83	93					
9	75	89	82	81					
10	NA*	NA*	86	91					
11	NA*	NA*	85	94					

Note: For plane trigonometry, the number of outcomes increased from nine to eleven effective the fall 2015. These changes were because of KCOG meetings.

Analytic Geometry and Calculus II and III (MATH 155 and MATH 253)

Course Outcome	MATH 155					MATH 253			
	13-14	14-15	15-16	16-17		13-14	14-15	15-16	16-17
1	60	88	70	62		85	NA	86	85
2	75	89	75	73		91	NA	82	91
3	80	91	74	56		83	NA	90	83
4	70	92	71	78		NA*	NA*	84	80
5	86	97	23	44		NA*	NA*	NA*	NA*
6	70	84	NA*	NA*					
7	77	96	NA*	NA*					
8	0	99	NA*	NA*					
9	0	99	NA*	NA*					

Note: In Analytic Geometry and Calculus II, the number of course outcomes changed from nine to five. The change was effective summer of 2015. The number of course outcomes for MATH 253 increased from three to five effective summer 2016. The highlighted region indicates that the course was not offered during that academic year. For some reasons, not all course outcome scores were recorded for MATH 253 in 2016/2017 as shown by NA*

Engineering Physics I Lecture and Lab (PHYS 104 and PHYS 140)

Course Outcome	PHYS 104					PHYS 140			
	13-14	14-15	15-16	16-17		13-14	14-15	15-16	16-17
1	NA	82	81	72		NA	80	82	75
2	NA	87	79	62		NA	89	87	75
3	NA	78	78	61		NA	88	79	90
4	NA*	NA*	NA*	NA*		NA*	NA*	NA*	NA*

Note: The number of course outcomes changed for Engineering Physics I lecture to four from two. However, only three outcomes are listed and the fourth is used as an outcome for Engineering Physics I lab outcome. The fourth outcome used in the lab has been split into three identifiable course outcomes for assessment purposes at NCCC. The changes to course outcomes have been adapted primarily due KCOG meetings. Initially, there used to be 2 course outcomes in lecture and 3 course outcomes in lab. The regions with an NA* indicates that the course was not offered during that academic year or the outcome score was never recorded.

Engineering Physics II lecture and Lab (PHYS 105 and PHYS 145)

Course Outcome	PHYS 105					PHYS 145			
	13-14	14-15	15-16	16-17		13-14	14-15	15-16	16-17
1	NA	NA	75	88		NA	NA	94	87
2	NA	NA	68	85		NA	NA	79	87
3	NA	NA	74	92		NA	NA	91	84
4	NA*	NA*	NA*	NA*		NA*	NA*	NA*	NA*

Note: The number of course outcomes changed for Engineering Physics II lecture to 4 from 2 in the lecture. As in Engineering Physics I, only 3 are listed and the fourth is used as an outcome for the lab section. The one outcome used in the lab is split into 3 identifiable course outcomes for assessment purposes. The changes to course outcomes were due to KCOG meetings. The highlighted region indicates that the course(s) was not offered during that academic year.

General Education Assessment

Courses offered under the Physics and Pre-Engineering program continue to be assessed according to the guidelines of assessment of courses at NCCC. Most of the courses in the program have been discussed in KCOG meeting and new outcomes have been developed. The new outcomes have already been utilized adopted.

Transferability of Program courses

Most of the courses in the Physics and Pre-Engineering program are transferring smoothly to regent's universities in Kansas. The smooth transfer has been in part due to KCOG meetings that have developed common learning outcomes for certain courses. Below are the course transfer equivalencies of NCCC core courses in program to regent's universities in Kansas

Course Transfer Equivalencies to Regents Universities

NCCC Course	University of Kansas	Kansas State University	Emporia State University	Pittsburg State University	Wichita State University	Fort Hays State University	Washburn University
PHYS 104	PHSX 211	PHYS 213	PHYS 190 PHYS 191 PHYS 192	PHYS 104	PHYS 313	PHYS 211	PS 281
PHYS 105	PHSX 212	PHYS 214	PH 393 PH 394 PH 395	PHYS 105	PHYS 314	PHYS 212	PS 282
PHYS 140	PHSX 216	PHYS 213	PHYS 190 PHYS 191 PHYS 192	PHYS 130	PHYS 315	PHYS 211L	PS 281
PHYS 145	PHSX 236	PHYS 214	PH 393 PH 394 PH 395	PHYS 131	PHYS 316	PHYS 212L	PS 282L
MATH 122	MATH 103	MATH 150	MA110	MATH 122	MATH123	MATH 122	MATH117
MATH 150	MATH 121	MATH 220	MA 161	MATH 150	MATH 242	MATH 234	MATH151
MATH 155	MATH 122	MATH 221	MA 262	MATH 155	MATH 243	MATH 235	MATH152
MATH 253	????	MATH 222	MA 263	MATH 253	MATH344	MATH 236	????

Note: ???? Regions indicate course equivalencies information was missing for the specified course. For the most part, most of our courses are transferring smoothly to the regent's universities in Kansas. MATH 155 and MATH 253 have not gone through the KCOG meetings yet.

Efforts to stay current in curriculum

Physics and Pre-Engineering program faculty are actively involved in many different professional activities on and off campus to stay current in the curriculum. Of importance, faculty in the area stays current in the curriculum by participating in statewide core competency KCOG meetings. Additionally, faculty specific efforts are:

Dr. Luka Kapkiai – Participated in a Renewable Energy Workshop at Wisconsin in the summer of 2016. Continued attendance in Association of American Physics Teachers (AAPT) conferences, and keep informed with activities of Missouri, Kansas and Oklahoma American Chemicals Society (MOKAN ACS) sectional meetings. Have participated in several professional development activities including being a member of 2016/2017 Kansas Community College Leadership Institute.

Mr. Nathan Stanley – Has attended KAMATYC conferences when possible and takes courses in curriculum & instruction through Baker University. Last spring, Nathan attended a conference on Assessment at Johnson County Community College (JCCC), and this March, he will be attending the League for Innovation in the Community College conference in Washington, DC as a recipient of the excellence award from the faculty category.

Mr. Paul Walcher – Paul Walcher stays current in his field mainly through conference activity: he attends the annual meeting of the American Mathematical Association of Two Year Colleges every other year and both attends the annual meeting and currently serves as president of the Kansas affiliate (KAMATYC). Paul also has attended at least one educational technology conference every year he has been at NCCC (iTRAC, KC Math Technology Expo). Additional Paul also serves as the college co-chair (beginning his sixth year in the position) of the mathematics committee for the Kansas Core Outcomes Group.

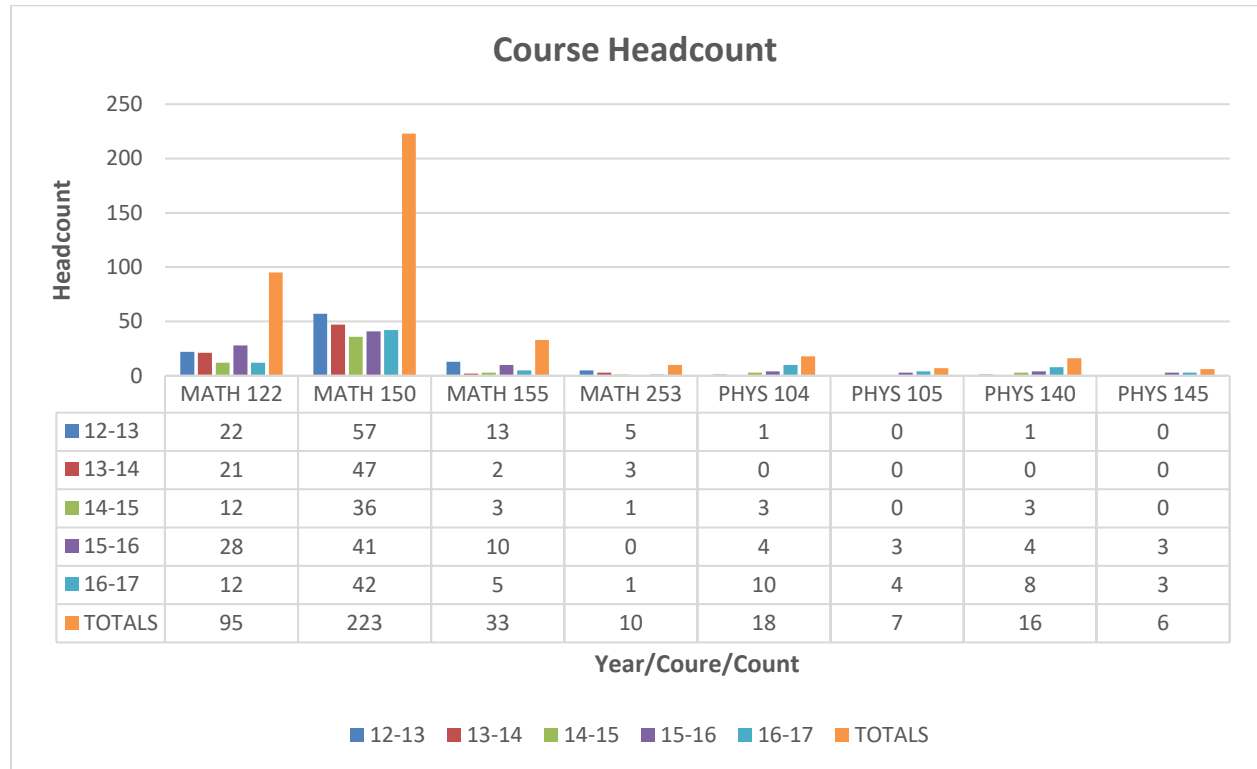
Section 3

Data – Enrollment and Costs

Headcount in Courses

The graph labeled Headcount shown below indicates the number of students enrolled in the specified courses within the program. Enrollment in Physics courses and Calculus III (MATH 253) have remained relatively low. The graph labelled course headcount shows course enrollments in the core program courses for the last five years.

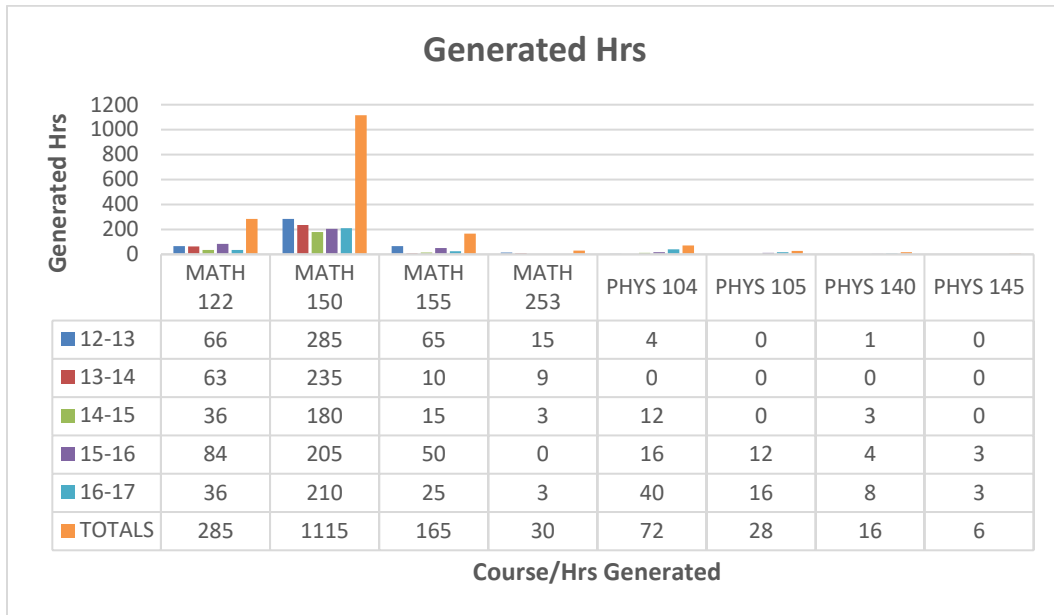
Course Headcount



Course credit hours generated

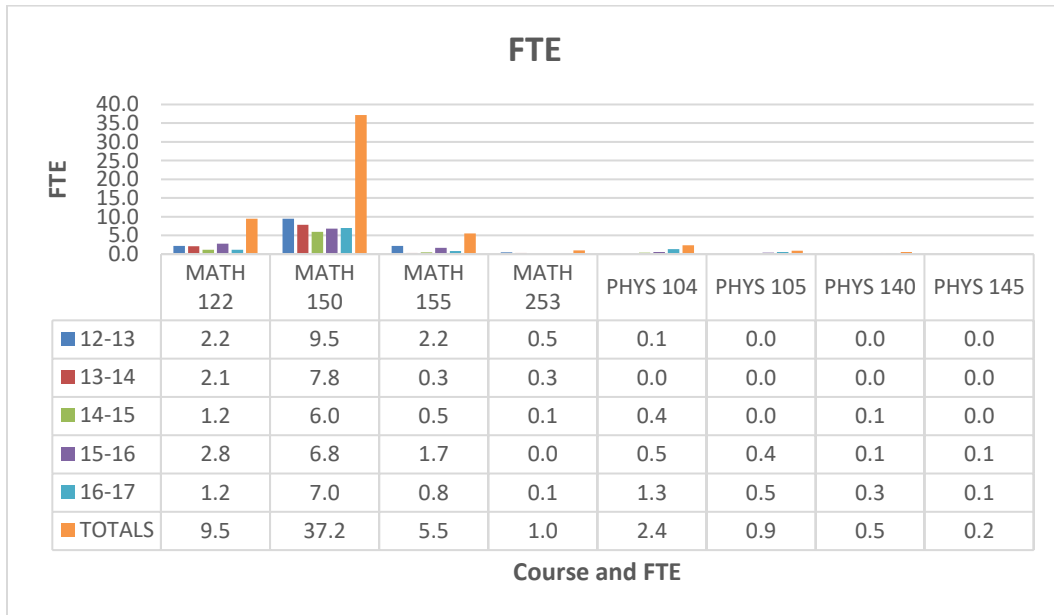
The graph labelled generated hours presented below shows the total number of generated hours for the specified courses in the program. There was a slight jump in the total number of generated hours from 2424 to 2656.

Generated Hours



FTE

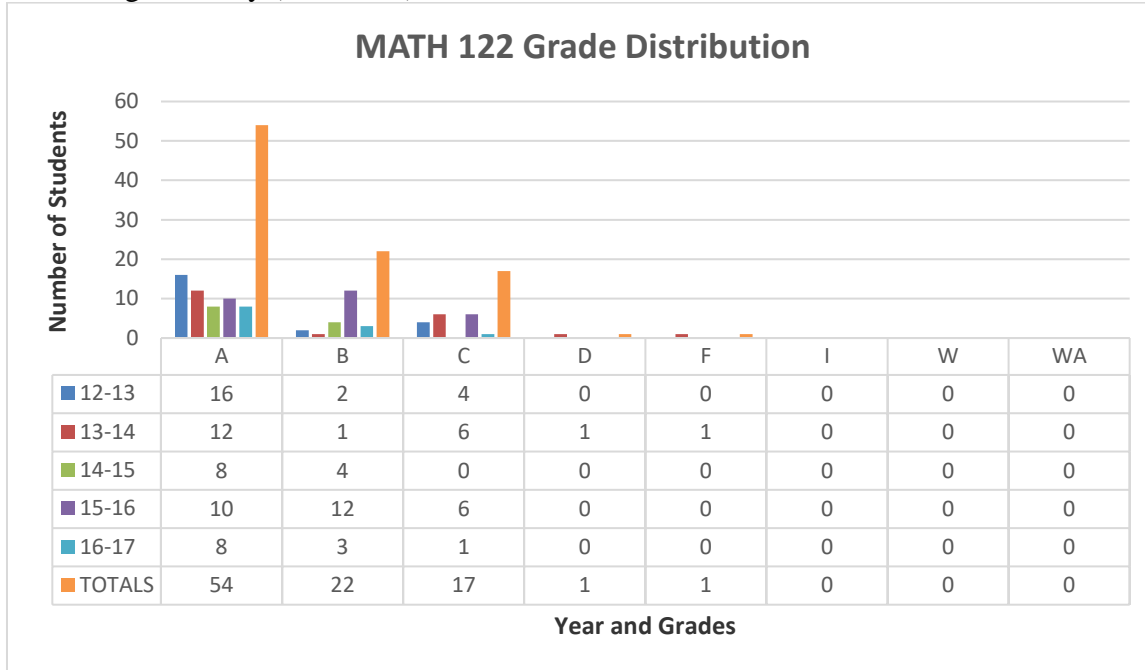
FTE of the Courses



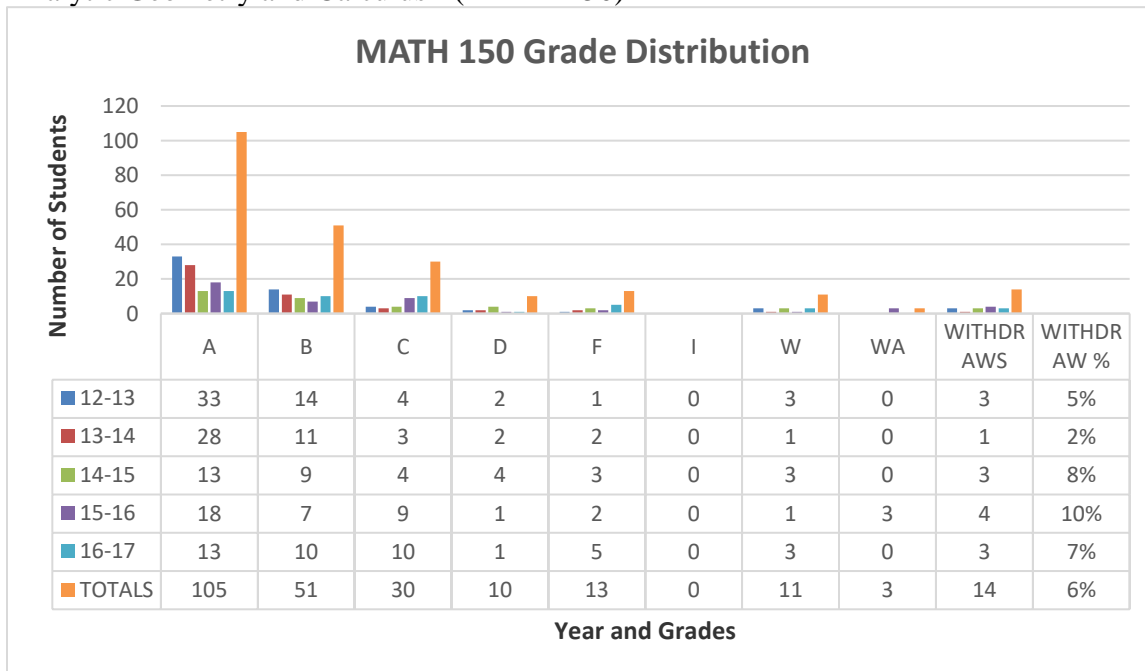
Course Grade Distributions

The graphs shown in this section represent the letter grades awarded in the various core courses of the program. For the most part, most of the students are achieving grades better than a C. Only in Analytic Geometry and Calculus I (MATH 150) do we see students being administratively withdrawn (WA).

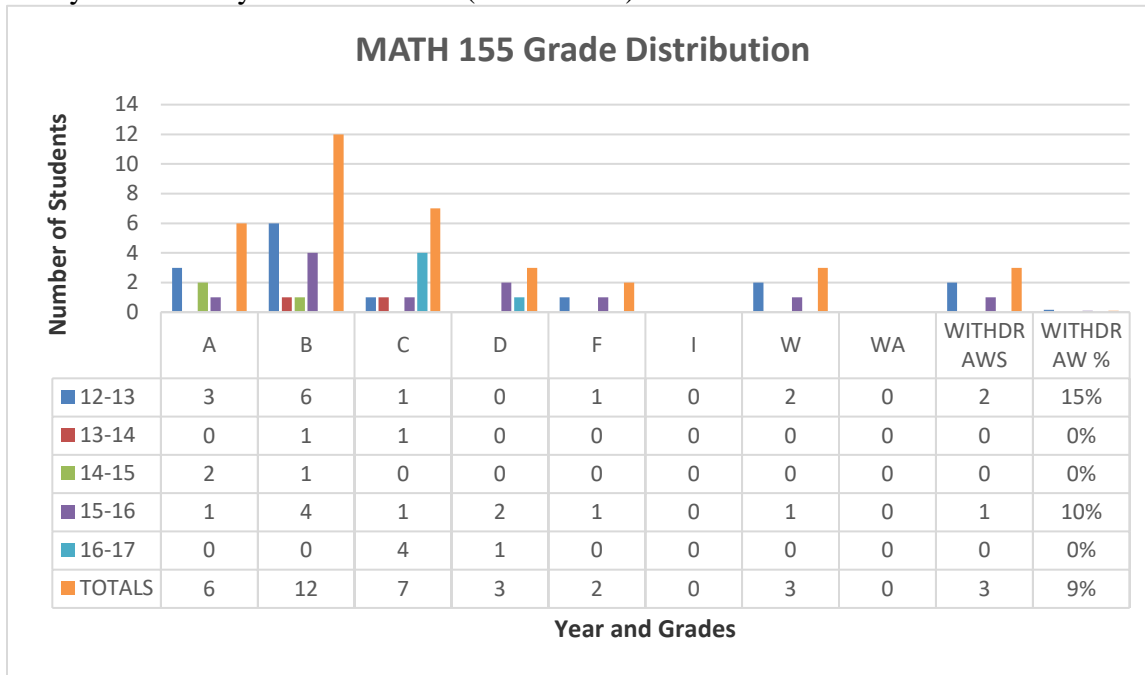
Plane Trigonometry (Math 122)



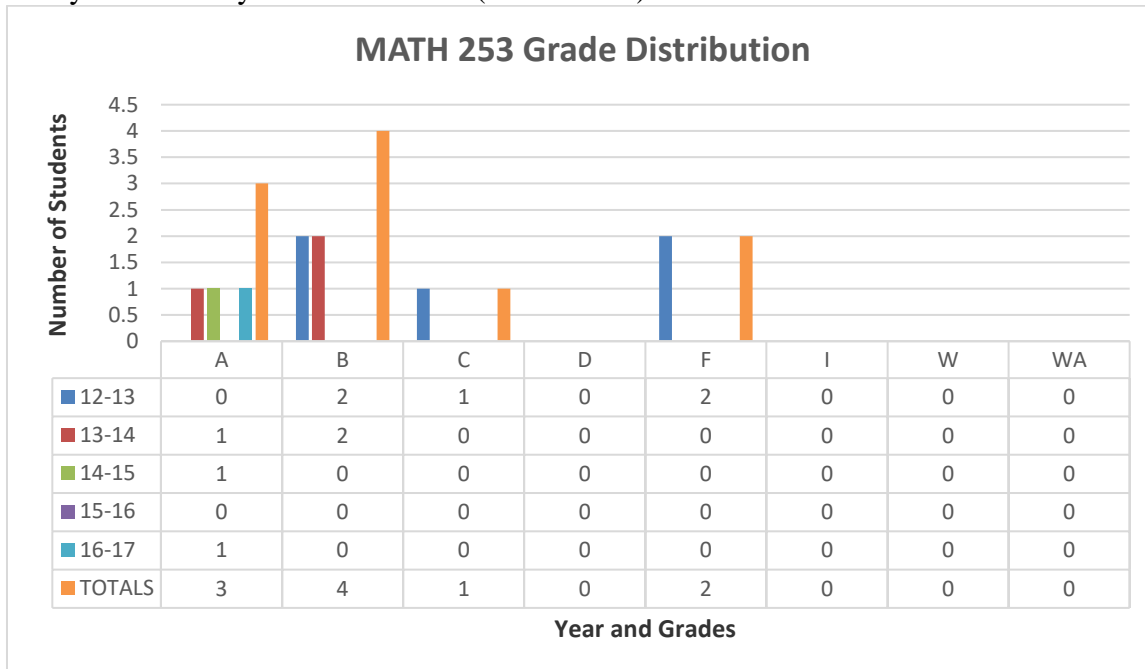
Analytic Geometry and Calculus I (MATH 150)



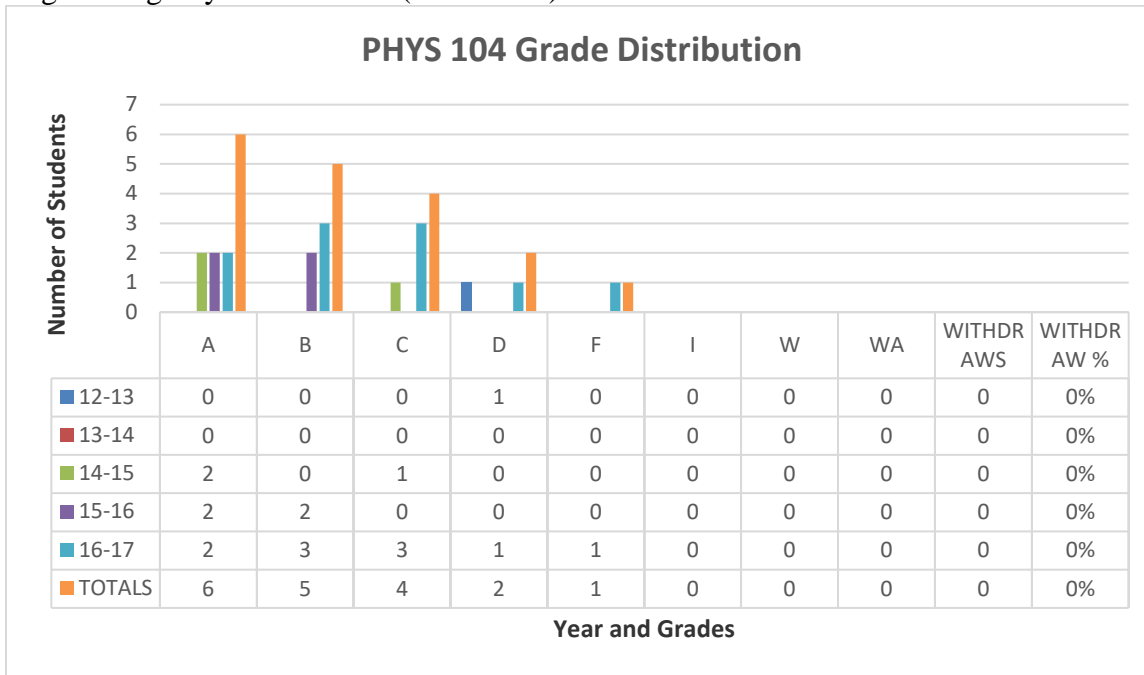
Analytic Geometry and Calculus II (MATH 155)



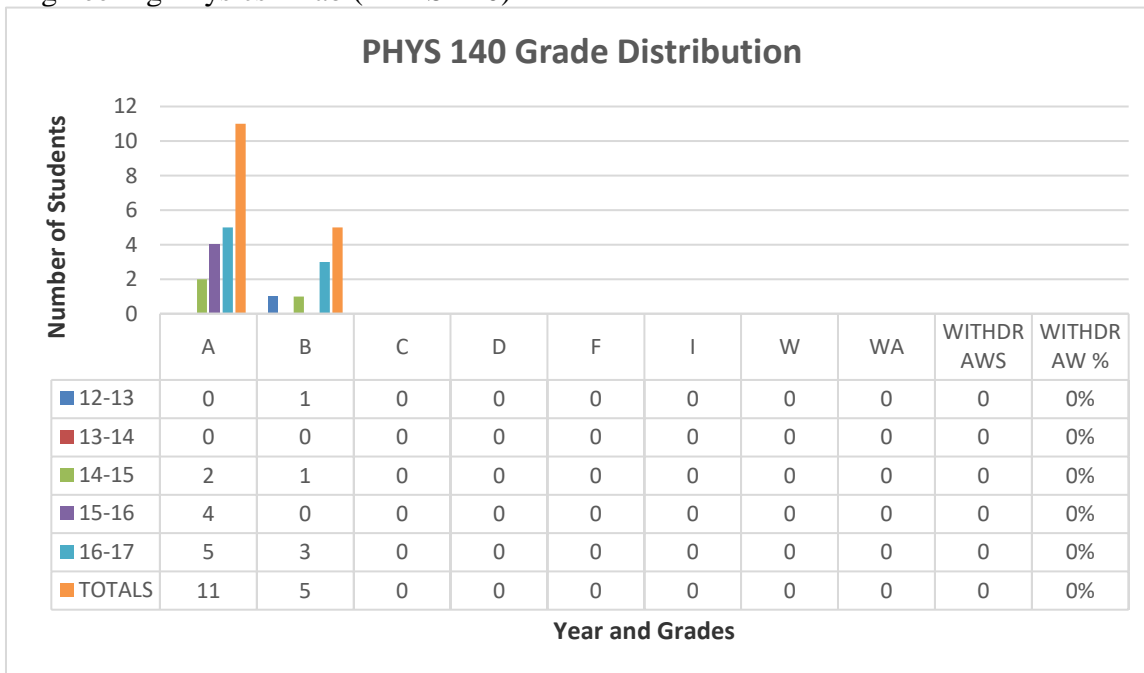
Analytic Geometry and Calculus III (MATH 253)



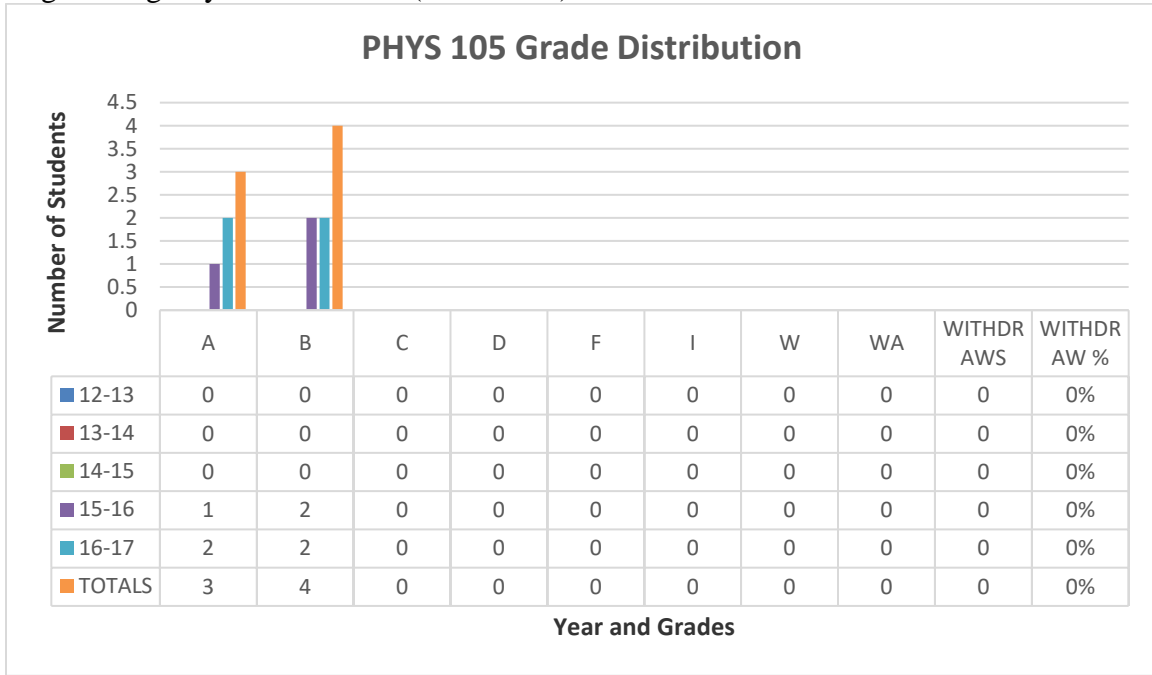
Engineering Physics I Lecture (PHYS 104)



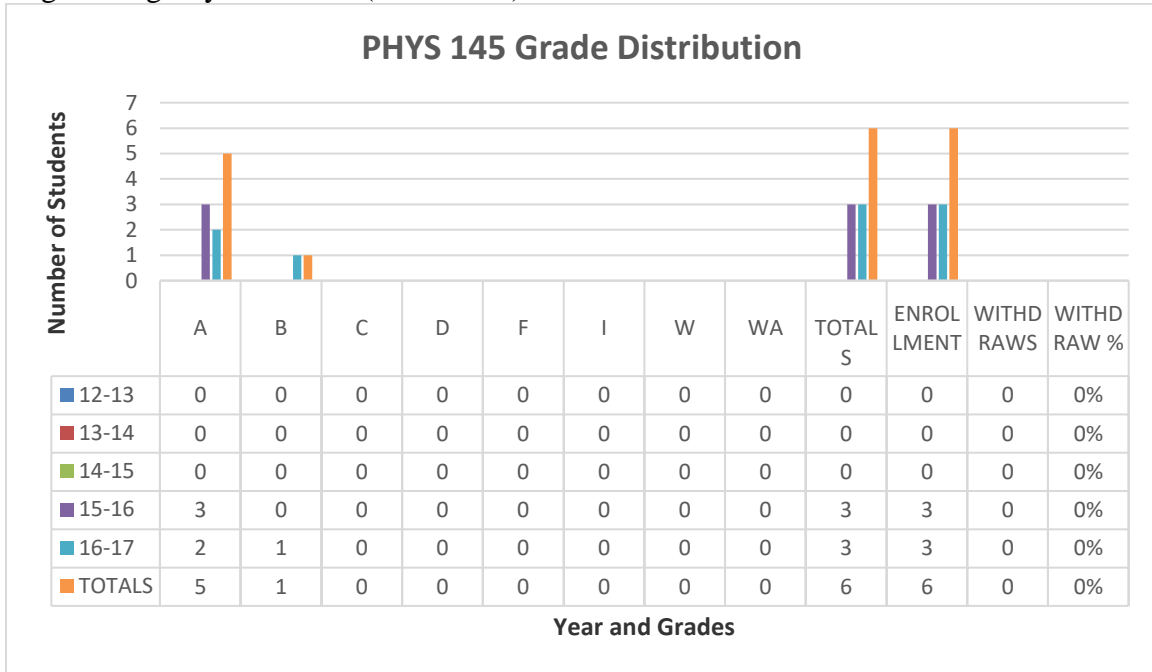
Engineering Physics I Lab (PHYS 140)



Engineering Physics II Lecture (PHYS 105)



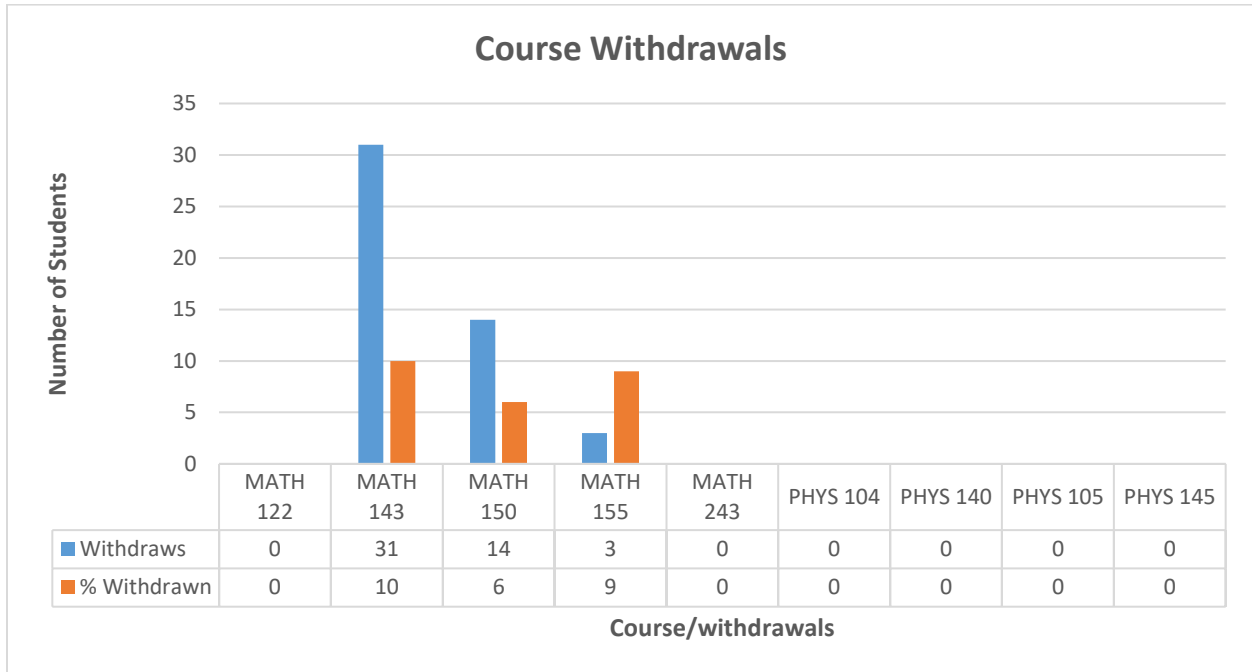
Engineering Physics II Lab (PHYS 145)



Course Withdrawal numbers and percentages

The data presented in the graphs below indicate the number and percentage of students who withdrew or who were withdrawn from the specified courses in the Physics and Pre-Engineering program. Only in Analytic Geometry and Calculus I (MATH 150) do we see students being administratively withdrawn or were awarded WA.

Course Withdrawals



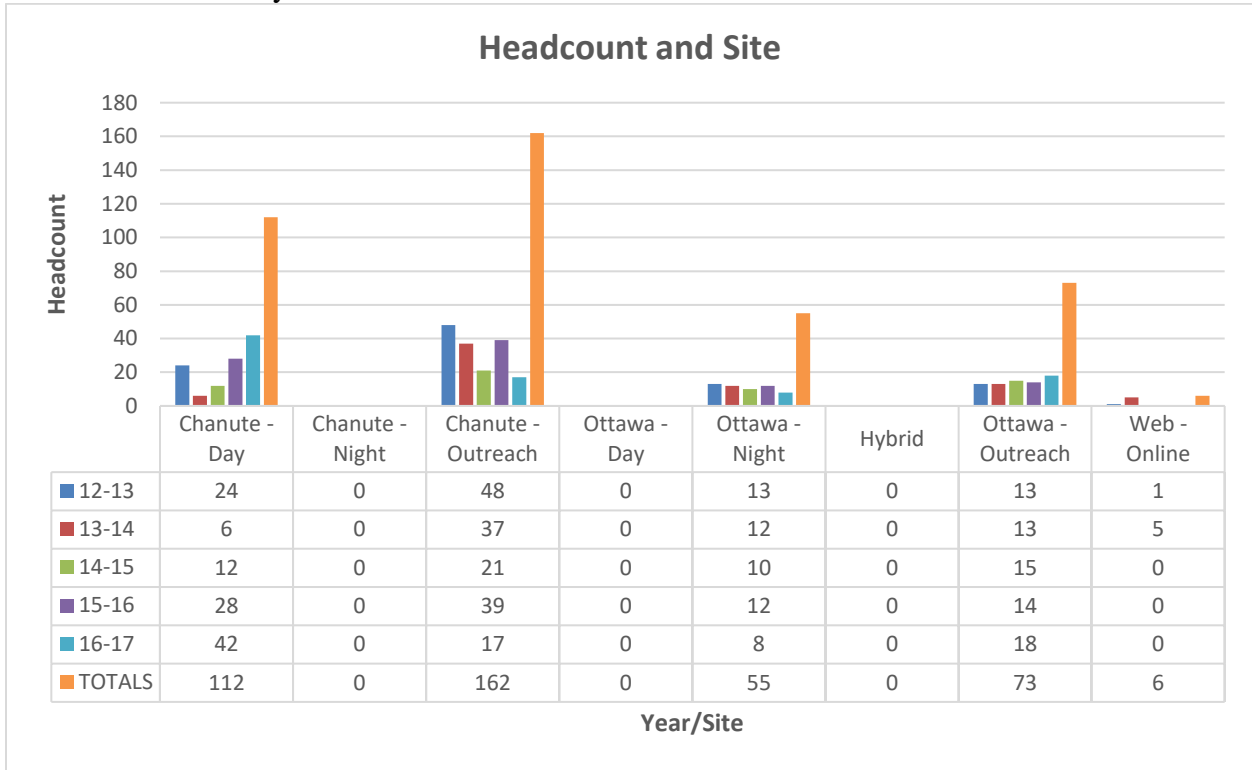
Enrollment by site and time

The graph labelled course enrollment by site and time presented below indicate the number of students enrolled in the core courses of the Physics and Pre-Engineering program at both the Chanute and Ottawa campus at the different times (day/night). Also presented in the graphs are the enrollments based on the times either day or night. In Chanute, students enrollments in courses are during the day while in the Ottawa campus, the enrollments are during the night. There were a total 6 students that were recorded to have taken a course(s) in the online environment. The students were in Physics and Plane Trigonometry.

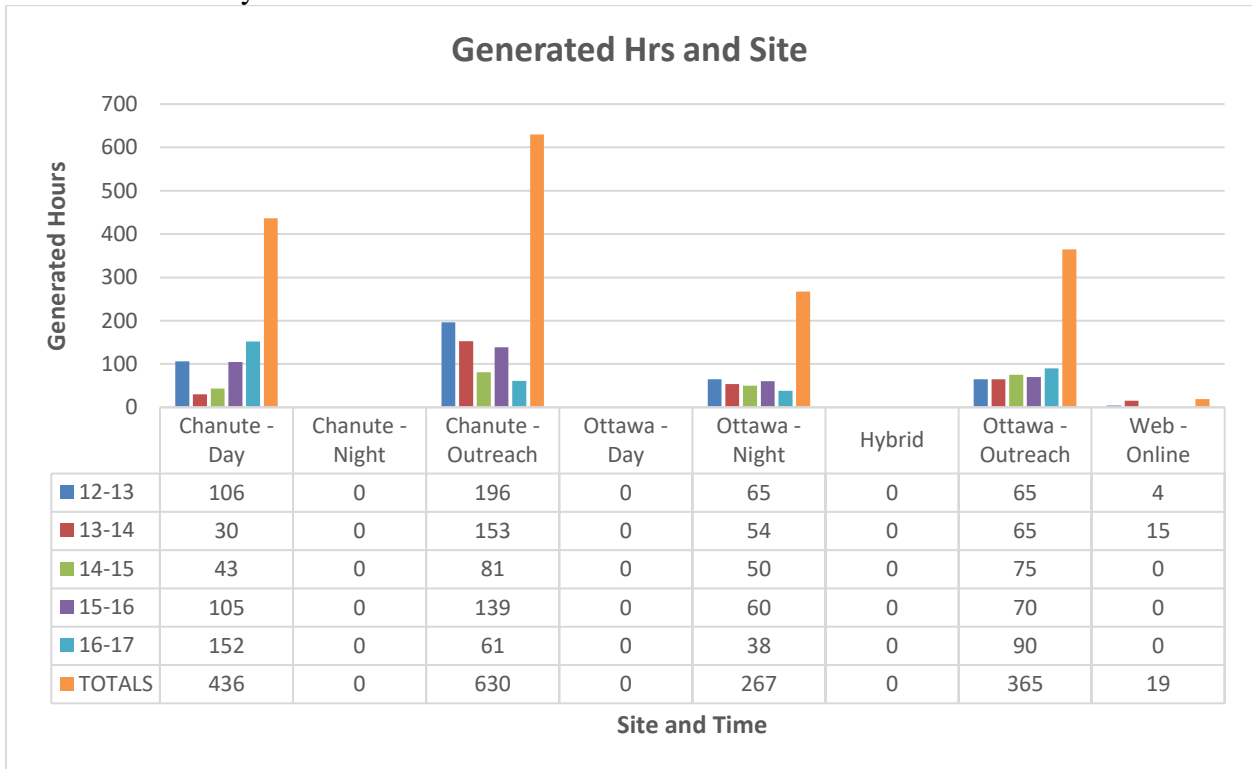
Credit hours generated

The graph labeled generated hours by site and time shows total generated hours in both the Chanute and Ottawa campuses, outreach sites as well as in the online environment. There were only a few hours generated in the online environment.

Course Enrollment by site and Time



Generated hours by Site and Time



Students in Physics and Pre-Engineering Program

There was a significant increase in the number of students that had expressed interest or were in the Physics and pre- engineering emphasis. There was a total of 26 students compared to 4 students during the review period of 2006-2012.

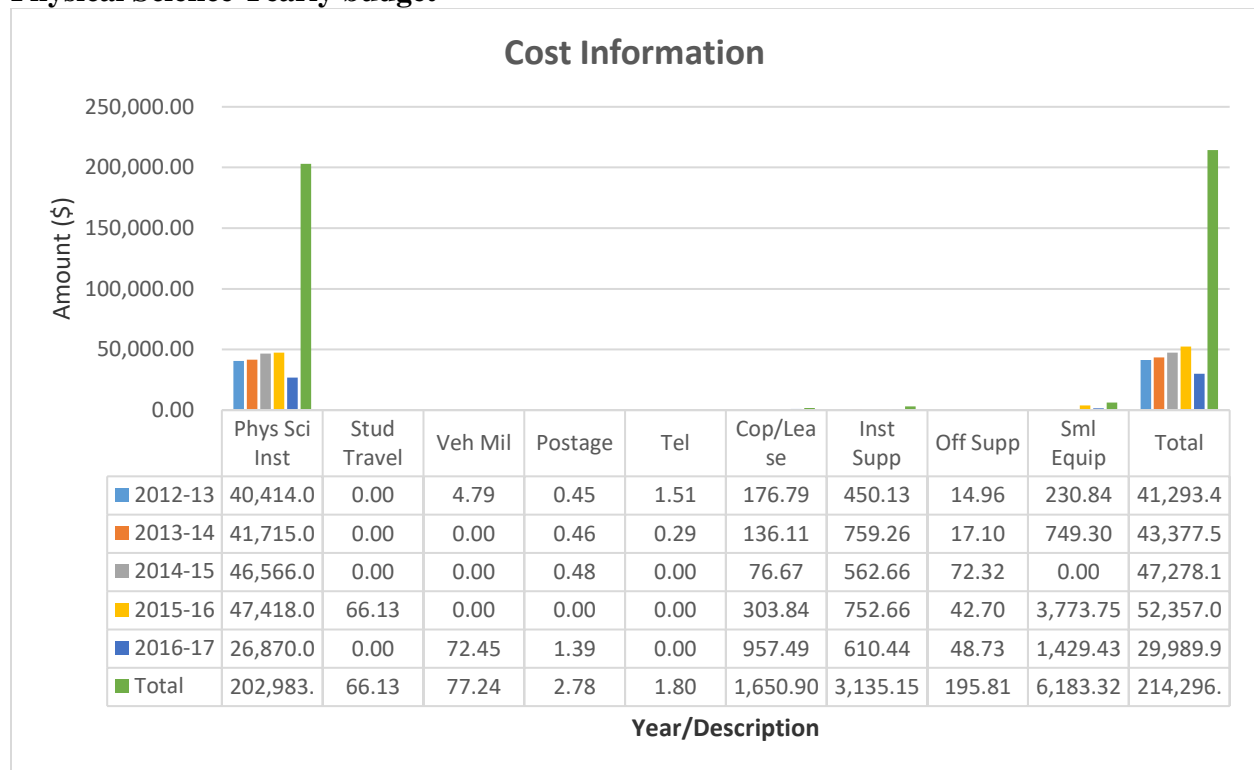
Graduates/Awards conferred

A total of 6 students were conferred Associate of Science in Physics and Engineering during this review period. Again, this was an improvement from zero during the last program review.

Cost information

The budget information provided below is for Chanute campus (Physical Science only). Math instructors have their own budgets. As such this cost information is not a complete reflection of the budget for the entire Physics and Pre-Engineering program.

Physical Science Yearly budget



Note: During the 2012 program review, the total expenditure was \$ 168,516.58 compared to \$ 214,296 for this program review period.

The cost for Adjunct instructors during the 2012 program review was \$ 93,500. For this program review period, the cost is \$ 51,300 based on 108 credit hours taught by adjunct instructors (108*475). The cost of adjunct instructors was calculated based on the number of credit hours taught by adjunct instructors for the review period. Since the last program review, the pay for adjunct instructors have changed from \$ 425 to \$ 475. The change in the pay begun the fall of 2016.

Section 4

Faculty

The associate of science in Physics and Pre-engineering Program had a total of 10 faculty members of which 3 were full-time and 7 were part-time instructors. Full time instructors taught 58 % of the courses and part-time instructors taught a total of 42 % of the courses. This was a slight improvement from the prior program review period of 2012 where it was 57 % and 37 % respectively.

Full-time Instructors Part-time Instructors

Luka Kapkiai
Nathan Stanley
Paul Walcher

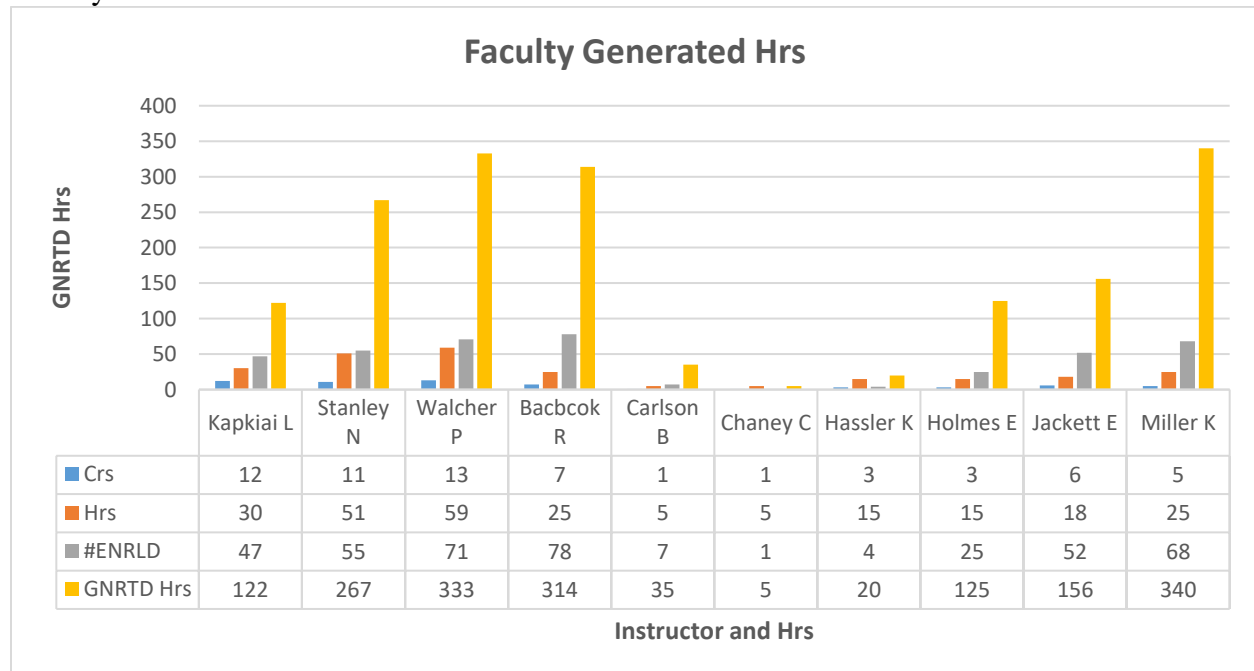
Rex Babcock
Brian Carlson
Craig Chaney
Kristopher Hassler
Eric Holmes
Elizabeth Jackett
Kristi Miller

Faculty Courses Taught % Courses Taught

Full-time	36	58
Part-time	26	42
Total	62	100

The information presented in the table below shows full-time and part-time instructors with the number of courses they taught, credit hours they generated and the total enrollments in the courses they taught.

Faculty course loads



Section 5

SWOT analysis of program based on above information

Strengths

- We have a great stability in our faculty. Mr. Walcher has been with the college for 6 years, Mr. Stanley has been with the college for 10 years, and Dr. Kapkiai has been with the college for 12 years.
- Our Physical Science lab has recently been renovated.
- The courses being offered under this program transfer smoothly to colleges and universities across the state. This has been improved significantly due to KCOG meetings.
- We continue to offer Physics and Mathematics courses to non-science majors
- We've developed relationship with Wolf Creek Power plant that allows us to take our students to tour their facility.
- Our students actively participate in interdisciplinary colloquium.

Weaknesses

- We do not have science scholarship opportunities available to science majors. Scholarship could have the potentials of increasing our enrollments.
- Our enrollments in Physics and Calculus II courses have low enrollments.

Opportunities

- We continue to explore internships opportunities in the local industries such as Ash Grove to our interested students.

Threats

- We continue to experience low enrollments numbers for Physics and Calculus courses.