**San Francisco State University**
**School of Engineering**

**Response to ABET Draft Statement**
**Accreditation Cycle: 2017-2018**

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***Deficiency for Electrical Engineering Program***

*Accreditation Policy and Procedures Manual (APPM) Section I.E.5.b.(1) of the APPM requires the team to examine the facilities to ensure that the instructional and learning environments are adequate and are safe for the intended purposes. The student power electronics laboratory (SCI 166), contains a large gray 480 VAC patch cord cabinet, characterized by a faculty member as obsolete equipment that was no longer used due to safety concerns. At the time of the visit, the equipment was energized with the meter reading ~500V. In addition, one or more of the patch cords had the potential to be energized at 480 VAC, presenting a significant electrical shock and arc-flash hazard. Neither the faculty member in charge of the laboratory nor the program head had knowledge of this legacy equipment or its status. A similar cabinet is also located in an adjacent laboratory (SCI 164). This equipment presents an extreme life-safety hazard for anyone using either laboratory. Therefore, the program is not in compliance with the requirement implicit in Section I.E.5.b.(1) of the APPM that learning environments be safe for the intended purposes.*

The faculty responsible for the laboratory spaces in rooms SCI 166 and 164 (along with many other School of Engineering faculty) believed these electrical power cabinets were decommissioned and no longer energized. Only after detailed discussions with campus electricians and a School of Engineering technician did it become apparent that the cabinets were in fact powered and operating – in a very limited capacity – to route electricity to certain portions of the laboratories. The electrical cabinets were not being directly used for any faculty research or student instructional activities; however, individuals tampering with the equipment could have been exposed to a significant electrical shock hazard. We are thankful to the ABET Program Evaluator (PEV) for helping us identify this safety hazard.

Immediately following the ABET visit in October 2017, access to the areas surrounding the electrical cabinets were limited to necessary personnel, who were advised of the potential safety hazards. The School of Engineering then worked with the Director of Operations of the College of Science and Engineering, Environmental Health & Safety (EHS), and Facilities Services to develop a way to prevent unauthorized access to the electrical cabinets. Several potential solutions were evaluated, including relocating the patch cables to behind the front panels, fabricating sheet-metal covers for the patch-cable connectors, and installing

lock-out boxes on the panel switches. Ultimately, the use of a metal cage to surround the entire front area of the cabinets was identified as the preferred solution that could ensure safety, allow access when necessary, and be implemented in a relatively short period of time. The Chief Engineer and Maintenance Superintendent of Facilities Services, in consultation with the School of Engineering, worked to design custom metal cages for the electrical cabinets. The design utilizes 2-in. × 2-in. square steel tubing and 1/2-in. #13 expanded steel to cover the front, sides, and top of the cages. Sliding and locking barrel latches secure doors such that the front of the cabinets can only be accessed electricians or other trained personnel. The cages were fabricated by an off-campus vendor and installed in SCI 164 in December 2017 and in SCI 166 in early January 2018, thus being in place before the start of the Spring 2018 semester. Images of the metal cages are shown in Figure 1. A detailed image of the 1/2-in. #13 expanded steel is shown in Figure 2. As shown in Figure 1, the cages allow for ventilation and prevent unauthorized access to the electrical cabinets without blocking the side (locked) access doors.

In parallel with these immediate efforts to ensure safety of the existing equipment, the School of Engineering and the College of Science and Engineering are evaluating options and seeking campus funds to replace the outdated electrical cabinets with more modern equipment.

**Figure 1**. Images of custom metal cages installed in front of electrical power cabinets in SCI 166 (left) and SCI 164 (right).

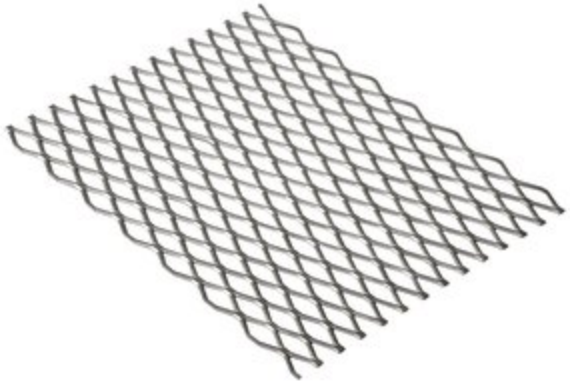

**Figure 2**. Detailed image of 1/2-in. #13 expanded metal (steel) used to cover the front, sides, and top of the cages.

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***Program Concern for Civil, Computer, Electrical, and Mechanical Engineering Programs***

*Criterion 1. Students This criterion requires that student progress be monitored to foster success in attaining student outcomes, thereby enabling graduates to attain program educational objectives. The program has a process for monitoring prerequisite satisfaction that requires the mapping and evaluation of a student's transfer credits to SFSU courses in order to ensure prerequisite requirements are met. Though advising does help students with proper course sequencing, the current procedures do not prevent a student who has not met all prerequisites from taking a course. When students are not adequately prepared to take courses, it is possible that their success in attaining student outcomes could be compromised. Thus, there is a potential that compliance with this criterion could be jeopardized.*

This concern was raised by the ABET evaluation team primarily due to rare instances in which certain students were able to bypass one or more course prerequisites. Investigation of the specific cases by the School of Engineering's Outcomes Assessment Committee (OAC)* traced these issues to the handling of course enrollment for students transferring from institutions for which articulation agreements are not in place. For first-time freshman, or for students transferring from institutions with which course articulations have been established, completed courses are correctly documented in the university's student information database, and satisfaction of prerequisites is readily verified by instructors via a "Prerequisite Roster" database function.

* Committee name is a historical artifact. In fact, the OAC is responsible for all assessment and accreditation matters for the School of Engineering.

For the small subset of transfer students for whom course articulations do not exist, the School of Engineering utilizes a manual procedure to document transferred courses (as described in detail in our ABET Self-Study Report). In short, students are required to meet with the Program Head to evaluate course transfers, which are then documented on a hard-copy student planning worksheet.

On occasion, students attempting to enroll in courses without documented completion of prerequisite(s) in the student information database will claim that they did in fact complete the prerequisite at another institution. Instructors must then manually check the student's planning worksheet, on file in the Engineering Office, to verify their claim. The majority of instructors follow through on this procedure but there are rare instances, especially involving part-time instructors, when oversights occur.

The underlying problem is that there exist legitimate cases in which the student information database indicates that a prerequisite has not been satisfied when it actually has. Following the visit by the ABET evaluation team, the School of Engineering met with representatives from Undergraduate Education and Academic Planning (UEAP) to develop a remedy for this problem. Following a series of meetings, a decision was made to utilize an existing university procedure to ensure that transfers of prerequisite courses are correctly recorded in the student information database, even when articulation agreements do not exist. The procedure involves the use of an Undergraduate Major Course Substitution/Waiver Form (Attachment A). Effective Spring 2018, when the Program Head evaluates the transfer of a prerequisite course that does not appear correctly on the student's database record, the Program Head completes the form and forwards it to the Registrar's Office via UEAP, so that it can be entered on the student's record and also documented as an articulated course (if appropriate). In this manner, evaluations of prerequisite compliance can be carried out using the student information database alone, and manual checking of prerequisites will no longer be required.

The university has also been working to establish a prerequisite checking procedure as part of its enrollment system, so that students are prevented from enrolling in a course without either having completed the prerequisite(s) or obtaining a course-add permission code. The School of Engineering is now scheduled for early implementation of this system, with a target implementation date of Spring 2019.

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***Program Concern for Electrical Engineering Program***

*Criterion 4. Continuous Improvement This criterion requires that the program regularly use appropriate, documented processes for accessing and evaluating the extent to which student outcomes are attained. While the program generally has robust methods of assessing and evaluating attainment of student outcomes, the attainment of student outcome (d) "an ability to function on multidisciplinary teams" is determined solely through instructor evaluation of teams in the culminating design project course ENGR 697. The culminating design course sequence ENGR 696/697 segregates disciplines into different sections. Further, about 25 percent of the students in ENG[R] 697 perform individual projects, rather than team projects. Therefore, the utility of measuring attainment of this outcome in ENGR 697 is questionable. Using only this method to evaluate the extent to which students can work on multidisciplinary teams could prevent faculty members from determining whether this outcome is being attained, and there is the potential future compliance with this criterion could be jeopardized.*

During the ABET visit, the EE PEV discussed this concern with program faculty, and provided further details regarding his concern. In particular, the PEV stated that he felt we did achieve student outcome (d) with regards to multidisciplinary teams; however, our evaluation of outcome achievement via a singular metric in ENGR 697 was viewed as inadequate. He suggested that we use laboratory group data from ENGR 300: Engineering Experimentation to make our assessment of outcome (d) more robust.

In response to the PEV's suggestion, the OAC worked to develop a course-based assessment (CBA) form for ENGR 300 to provide additional metrics to assess the achievement of student outcome (d). This form (which also includes performance criteria to assess outcomes (b) and (k)) is provided in Attachment B and will be added to our slate of CBA tools in future assessment cycles. In addition, student data from Fall 2017 was used to evaluate the outcome (d) performance criteria using this new ENGR 300 CBA form. The collected data is provided in Figure 3 and Attachment C. The results do support that student outcome (d) is currently being achieved.

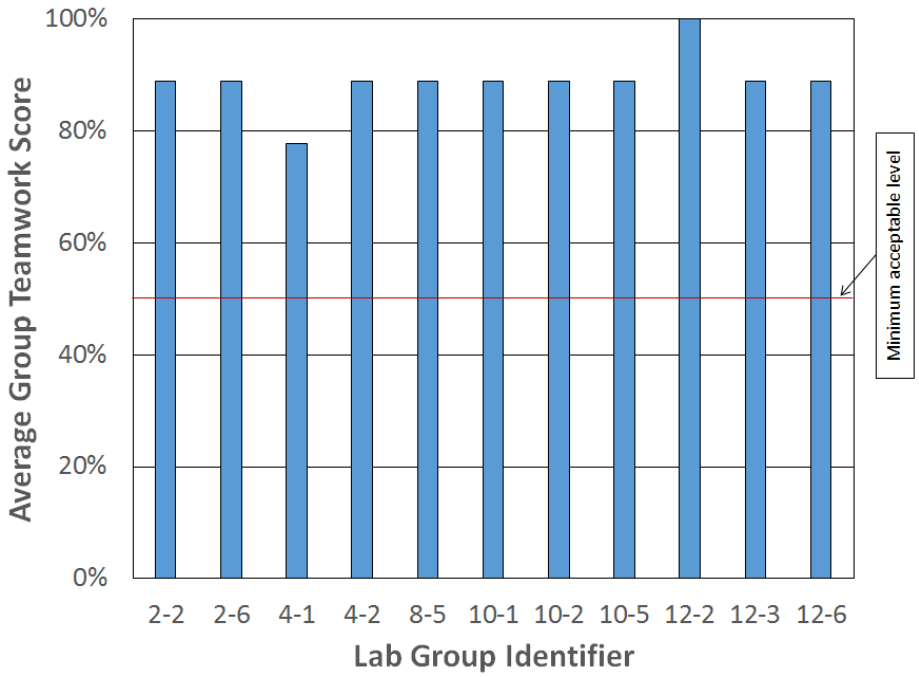


**Figure 3**. ENGR 300 average effective teamwork scores for lab groups having EE students. Data converted from 1-3 rubric to percentage score, with 1 (exemplary) = 100% and 3 (unacceptable) = 0%. Minimum acceptable level is 2 (acceptable) = 50%.

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***Program Concern for Computer, Electrical, and Mechanical Engineering Programs***

*Criterion 6. Faculty This criterion requires the program to demonstrate that the faculty members are of sufficient number and have the competencies to cover all of the curricular areas of the program, to accommodate adequate levels of student-faculty interaction, student advising and counseling, to accommodate university service activities, professional development, and to support interactions with industrial and professional practitioners, as well as employers of students. The current program faculty size is adequate to meet instructional and administrative needs, but faculty members have little time to advise students, meet with industry and professional practitioners, or pursue professional development. Continued increases in enrollment without commensurate increase in faculty size would place additional time demands on the faculty, potentially having a negative impact on advising and the quality of the student's professional development. Thus, there is the potential that future compliance with this criterion could be jeopardized.*

The Computer, Electrical, and Mechanical Engineering degree programs have recently attracted a lot of student interest. Thus, student enrollments have grown rapidly. In response to this, the University has granted two tenure-track faculty positions to the School of

Engineering this year (2017-18). The faculty and the Director of the School of Engineering are in the process of interviewing top candidates that will start this upcoming Fall 2018 semester. In addition, the Department of Computer Science was also granted two tenure-track faculty positions this year that will also begin in Fall 2018. These Computer Science faculty are likely to work collaboratively with the School of Engineering in several programs such as Computer Engineering and Electrical Engineering. It is anticipated, given the strength in student enrollments in the School of Engineering, that the University will continue to prioritize faculty positions for the School of Engineering.

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Program Concern for Mechanical Engineering Program

*Criterion 7. Facilities This criterion requires that classrooms, offices, laboratories, and associated equipment be adequate to support attainment of the student outcomes and to provide an atmosphere conducive to learning. It further states that modern tools, equipment, computing resources, and laboratories appropriate to the program must be available, accessible, and systematically maintained and upgraded to enable students to attain the student outcomes and to support program needs. The continuing increase in enrollment is steadily reducing student hands-on access to equipment. Much of the equipment is dated. Facilities available for instruction and student support have reached capacity and it appears that there is no established mechanism for supporting continued growth. Without access to appropriate instructional equipment located in spaces that encourage effective student learning, student ability to attain student outcomes is in question. Thus, there is the potential that future compliance with this criterion could be jeopardized.*

In response to increased Mechanical Engineering enrollments, the College of Science and Engineering has prioritized instructional equipment requests from the program. Following the ABET visit, ME faculty identified a comprehensive list of laboratory equipment in need of replacement and compiled approximately $200,000 in equipment requests. We are optimistic that many of these requests will be approved, and will continue to be aggressive in seeking instructional equipment funding in future years.

In addition, the School of Engineering has been very successful in obtaining external grants to fund equipment purchases. Over the past two years, Engineering has received two grants totaling $800,000 from the NSF Major Research Instrumentation (MRI) program. Equipment from these grants are still in the process of being purchased, installed, or commissioned, and will support student instruction as well as faculty research.

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Program Concern for Civil Engineering Program

*Criterion 8. Institutional Support This criterion requires that resources including institutional services, financial support, and staff (both administrative and technical) provided to the program be adequate to meet program needs. It further states that the resources available to the program must be sufficient to attract, retain, and provide for the continued professional development of a qualified faculty as well as to acquire, maintain, and operate infrastructures, facilities, and equipment appropriate for the program, and to provide an environment in which student outcomes can be attained. Although professional development grants of up to $1,500 per year are available for faculty to attend conferences, this amount does not generally cover the costs of registration and travel expenses for conferences. This limited funding for professional development makes it more difficult for the faculty to remain current in their profession. In addition, continued enrollment increases are now taxing facilities and program equipment, making it more difficult to maintain an effective learning environment and attainment of student outcomes increasingly less certain. Several laboratories have dated equipment.*

*Without adequate support for faculty professional development as well as program facilities and updates to critical equipment, there is the potential that compliance with this criterion could be jeopardized.*

*Program Concern for Computer, Electrical, and Mechanical Engineering Programs*

*Criterion 8. Institutional Support This criterion requires that resources including institutional services, financial support, and staff (both administrative and technical) provided to the program be adequate to meet program needs. It further states that the resources available to the program must be sufficient to attract, retain, and provide for the continued professional development of a qualified faculty as well as to acquire, maintain, and operate infrastructures, facilities, and equipment appropriate for the program, and to provide an environment in which student outcomes can be attained. Continued enrollment increases are now taxing facilities and program equipment, making it more difficult to maintain an effective learning environment and attainment of student outcomes increasingly less certain. Several laboratories have dated equipment. Without adequate support for program facilities and updates to critical equipment, there is the potential that compliance with this criterion could be jeopardized.*

The School of Engineering and the College of Science and Engineering are working with the University administration to address program needs in the areas of facility improvements and staffing. We are currently in the process of hiring one administrative staff position in the

School of Engineering office, and seeking approval for one additional technical staff (technician) position.

With regards to the program-concern language specific to Civil Engineering, many faculty utilize external grants to fund conference travel and attendance, and additional School and Dean's Office support is available to augment the funds provided by the University Faculty Travel Awards.

ATTACHMENT A

# Undergraduate Major Course Substitution/Waiver Form

**Major** _____ **Minor** _____ Print Form

## Instructions:

1. A separate form is needed for each major or minor department
2. Complete Part I through Part IV. An incomplete form will not be accepted for processing.
3. Submit form to Office of the Registrar Office SSB 101, One Stop Student Services, or mail to: Office of the Registrar, DPR Unit, San Francisco State University,1600 Holloway Avenue, San Francisco, CA 94132.
4. Major departments should indicate if a course is recommended for review by the University Articulation Officer.

## Part I: Student Information

SFSU ID _____ Last name _____ First name _____

Phone# _____ Email _____

Expected Term of Graduation _____

## Part II: Substitution Details – requires Advisor or Departmental Chair in Part IV

If course was completed at another college, please indicate the college and exact course prefix, course number, and course units in the space provided:

| Course Required | | | Substituted Course | | |
|---|---|---|---|---|---|
| Course | Name of Institution | Units | Course | Name of Institution | Units |
| | | | | | |
| | | | | | |
| | | | | | |

Comments (if any)

## Part III: Addition, Deletion or Waiver

| Action(please specify) Add, Delete, or Waive | Course | Name of Institution | Term/Year | Units |
|---|---|---|---|---|
| | | | | |
| | | | | |

## Part IV: Approval Signature:

| | |
|---|---|
| Advisor's Printed Name/Signature/Date | Departmental Chair's Printed Name |

☐ Course recommended for articulation review

San Francisco State University School of Engineering
Course: **ENGR 300** Instructor: [instructor]

# Course: ENGR 300
# Instructor: [instructor]

## Summary of outcomes, performance criteria and metrics

We are using this course to assess the following student outcomes:

(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(d) an ability to function on multidisciplinary teams
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

We have identified the following performance criteria that can be used to assess these outcomes. These criteria are listed below along with the metric to be used.

| No. | Outcome | Performance Criterion | Metric |
|---|---|---|---|
| 1 | (b) | Students are able to conduct experiments, and analyze and interpret data | Lab report grades |
| 2 | (d) | Student works in lab group with students from other disciplines | Student lab group assignments |
| 3 | (d) | Student is able to work effectively in multidisciplinary teams | Faculty evaluation via rubric |
| 4 | (k) | Students are proficient in using data acquisition software and instrumentation during laboratory experiments | Lab practical exam grades |

There are **four (4) metrics** to be used in this course. General instructions for data collection, analysis and reporting are provided on the next page.

1. **Lab report grades**
2. **Student lab groupings**
3. **Rubric for effective teamwork**
4. **Lab practical exam grades**

# General instructions for data collection, analysis and reporting

There are two parts to the assessment process for this course: **data collection and analysis**, and **preparation of the course assessment report**.

## *Data collection and analysis*

In this course, there are **four metrics** for which data needs to be collected:

1. **Lab Report Grades**
   Instructor tabulates students' laboratory report (and technical memorandum) grades.
2. **Student Lab Groupings**
   Instructor documents laboratory groups by student degree program (major).
3. **Rubric for Effective Teamwork**
   Instructor completes assessment (rubric) of team functioning.
4. **Laboratory Practical Exam Grades**
   Instructor tabulates students' grades from the laboratory practical exam.

We ask you to collect and analyze data for each of these metrics. To make your job easier, we have prepared a **Data Collection Instructions and Reporting Form** for each metric. The form provides instructions on how to collect the appropriate data and analyze it. The form also provides a place for reporting the results and requests comments if results fail the acceptance criterion.

## *Preparation of the course assessment report.*

When you have finished the collection and analysis process, you will need to prepare an Assessment Report consisting of the following:

- Data Collection Instruction and Reporting Forms, with Data Collection Forms attached.
- If any of the metrics fail the performance criterion, please comment on why you feel it failed and what modification to the course content and/or instructional methods might improve student performance.

# Lab Report and Lab Practical Exam Grades

## Data Collection Instructions and Reporting Form

### *Purpose*

This metric is used to assess the following performance criteria

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

### *Instructions for data collection*

This page gives a form for assessing the overall performance of the class on each of the performance criteria. The instructor should choose a minimum of five lab reports and also document scores from the lab practical exam.

### *Reporting*

- For performance criteria 1, identify the lab experiment for which scores are being reported
- For each performance criteria, tabulate the average score (normalized to 100%), std. dev and number of students.

| Performance Criterion | Lab Exp Name or Lab Practical | Average Score (0-100%) | Number of students | Acceptance Criteria (%) |
|---|---|---|---|---|
| 1 | [lab name] | | | 70 |
| 1 | [lab name] | | | 70 |
| 1 | [lab name] | | | 70 |
| 1 | [lab name] | | | 70 |
| 1 | [lab name] | | | 70 |
| 4 | Lab Practical | | | 70 |

# Student Lab Groupings

## Data Collection Instructions and Reporting Form

### *Purpose*

This metric is used to assess the following performance criteria

(d) an ability to function on multidisciplinary teams

### *Instructions for data collection*

This page gives a table that should be completed to document the laboratory groups and group member degree programs.

### *Reporting*

In the table, place a check or 'X' under the student's degree program

| Lab Group | Student identifier | Civil Engineering | Computer Engineering | Electrical Engineering | Mechanical Engineering |
|---|---|---|---|---|---|
| 1 | [initials | | | | |
| 1 | or | | | | |
| 1 | last 4 | | | | |
| 1 | of SID] | | | | |
| 2 | | | | | |
| etc. | | | | | |

# Rubric for Effective Teamwork

Data Collection Instructions and Reporting Form

## *Purpose*

This metric is used to assess the following performance criteria

(d) an ability to function on multidisciplinary teams

## *Instructions for data collection*

At the end of the semester, the instructor should score each lab group's teamwork effectiveness (overall, throughout the semester) according to the following rubric:

| **Unacceptable 3** | **Acceptable 2** | **Exemplary 1** |
|---|---|---|
| Lack of contact and coordination | All members participate but not equally | Members are enthusiastic about the project and work well with each other. |

## *Reporting*

After completing the table, compute the average teamwork score for the class.

| Lab Group | Teamwork score (1-3) |
|---|---|
| 1 | |
| 2 | |
| etc. | |

Average: _____

Acceptance criteria: average of 2.0 or better (lower)

San Francisco State University School of Engineering
Course: **ENGR 300** Instructor: Ozer/Sinha

# Student Lab Groupings

## Reporting Form

Data from Fall 2017, only showing ENGR 300 groups for which EE students were members:

| Lab Group | Student identifier | Civil Engineering | Computer Engineering | Electrical Engineering | Mechanical Engineering |
|---|---|---|---|---|---|
| 2-2 | DMD | | x | | |
| 2-2 | MOG | | | | x |
| 2-2 | KRH | | | x | |
| 2-6 | GGW | | | | x |
| 2-6 | CKY | x | | | |
| 2-6 | RZ | | | x | |
| 4-1 | AMA | | | | |
| 4-1 | KPB | | | x | |
| 4-1 | MAB | | | | x |
| 4-2 | DRCC | | | x | |
| 4-2 | CC | | | x | |
| 4-2 | KIDC | x | | | |
| 8-5 | MDS | | | x | |
| 8-5 | CS | x | | | |
| 8-5 | VET | x | | | |
| 10-1 | DMS | | | x | |
| 10-1 | JAV | | | | x |
| 10-1 | BJCM | | | | x |
| 10-2 | CG | | | x | |
| 10-2 | QLS | | | | x |
| 10-2 | MBJ | | x | | |
| 10-5 | ZBAA | | | | x |
| 10-5 | MRBC | | | x | |
| 10-5 | JLP | | | x | |
| 12-2 | KL | x | | | |
| 12-2 | JCH | | | | x |
| 12-2 | VEV | | | x | |
| 12-3 | RNW | | | | x |
| 12-3 | LAG | | | | x |
| 12-3 | AAES | | | x | |
| 12-6 | AGN | | | x | |
| 12-6 | BSMG | | | | x |
| 12-6 | DTW | | x | | |

Note: No degree program was checked for students on ‘Undeclared-BA’ plan