Human Anatomy and Physiology I:

A Review of Student Pass/Fail Ratios (P/F) by BIOL 223 Pre-Requisite (BIOL 190/L *v* CHEM 121)

An Evidence-Based Assessment Study in Student Success

by

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Accreditation-Mandated Assessment

Institutionally-Mandated Assessment

Annual Plan 2019-2020

Self-Evaluation 2018-2019

Articulation Form Submission – Science Pre-Req Changes to BIOL 223 at WNC

Abstract/Executive Summary

Data was obtained from WNC-IR pertaining to student success in BIOL 223, vis-à-vis science pre-requisite (BIOL 190/L v CHEM 121). Data is described in the main text. While there were numerous and multiple course repeaters, data that fit the experimental inclusion criteria (BIOL 190 and CHEM 121 as the only pre-req courses taken in the semester immediately prior to taking BIOL 223) were examined for Passing (P) and Failing (F) to generate a Pass/Fail (P/F) ratio to determine the pre-requisite course that contributed to the greatest success for students enrolling in BIOL 223. Whilst there were no statistical differences between the passing and failing grades of students who completed either pre-requisite course in advance of completing BIOL 223 at WNC, the difference was in the P/F ratios: 4.071 for students pre-req'ing BIOL 190/L v 2.538 for students pre-req'ing CHEM 121. When compared, the P/F ratio is 1.604 times higher for students who took BIOL 190 prior to BIOL 223, compared to those taking CHEM 121. F/T BIOL faculty have agreed as a department that CHEM 121 needs to be removed as a pre-requisite for BIOL 223. WNC Curriculum Form to adjust the pre-requisite for BIOL 223 is in **Appendix 3** of this report.

Introduction

At present, the nation-wide gold standard pre-requisite course for students desiring to study about Human Anatomy and Physiology (A&P I at WNC) is an introductory, college freshman-level Biology course in Cellular and Molecular Biology. At WNC, that course is BIOL 190/L, soon to be BIOL 190 (lab recombined with the lecture for 4 credits, beginning Fall 2019).

Historically, the BIOL/CHEM Department (for want of a better word) has provided pre-nursing science courses in a pre-requisite manner virtually since WN[C]C's inception. To that end, for many years, BIOL (and CHEM) faculty accepted CHEM 121, de facto, as the pre-requisite course to BIOL 223, Human Anatomy and Physiology I, without any critical discussions and to blindly support the Nursing Program at WN[C]C, rather than the BIOL students heading that direction.

The "Great Recession", coupled with NSHE directives regarding the number of credit hours that were to be included in associate degree programs, caused a great deal of disruption in all associate degree programs, including forcing an academic review of pre-requisite courses for appropriateness.

Upon that review, BIOL 190/L was re-instated (after many years) as a pre-requisite to BIOL 223 amidst great wailing and gnashing of teeth.

It has been 3-5 years post that change and assessment, high on the Institution's list of activities for re-accreditation by the Northwest Accreditation Commission, has been brought to bear upon BIOL 223 and its pre-requisites, administratively.

From a more practical and anecdotal perspective, it has been observed and discussed amongst colleagues and students, alike, that students who completed CHEM 121 seemed to be struggling substantially more in BIOL 223 than their counter-parts who completed BIOL 190/L.

This assessment, then, was specifically tailored to explore exactly that issue to establish/verify alignment with WNC's Strategic Goal #1: Improve Student Success Rates.

Methods

Data Acquisition

Record-level, raw, anonymized data was obtained regarding BIOL 223 as follows:

> Students were only enrolled in the following BIOL 223 Sections and Semesters at WNC: 2014-03 1003; 2015-01 1003; 2015-03 1003; 2016-01 1003; 2016-03 1003; 2017-01 1003; 2018-01 1003; 2019-01 1003 (8 semesters' worth of data).
>
> Experimental criteria were that BIOL 190 and CHEM 121 were taken as the only pre-req course completed in the semester immediately prior to the student taking/completing/matriculating, in one for or another, BIOL 223.
>
> There was a total of 169 "entries" (single course takers and multiple course repeaters). Of these, 52 entries didn't meet criteria for study inclusion. 71 entries from BIOL 190 met study inclusion criteria. 46 entries from CHEM 121 met study inclusion criteria.

All raw, record-level, anonymized data came through WNC-IR.

Statistics

Students Two-Tailed t-Test for significance was utilized to determine differences between groups of data. Maximum accepted probability for statistical difference was traditionally set at $p < 0.05$.

Any remainder of statistical terms and applications, e.g., mean, median, standard deviation and mode, originate in Microsoft Excel.

P/F Ratio: The P/F ratio is simply the raw number of students passing either course divided by the raw number of students failing either course.

Pass/Fail Criteria/Definitions

A grade of C or better was determined to be the "Pass" group and less than, or equal to, a C- was determined to be the "Fail" group as these courses were under the purview of the minimum "C" grade for application to WNC's Nursing Program for admission.

Results

Figures 1 and 2, Appendix 1, illustrate the results of this study. The P/F ratios are 4.071 for students pre-req'ing BIOL 190/L v 2.538 for students pre-req'ing CHEM 121. When compared, the P/F ratio is 1.604 times higher for students who took BIOL 190 prior to BIOL 223, compared to those taking CHEM 121 prior to taking BIOL 223.

There was no statistical difference between final course (BIOL 223) grade vis-a-vis' pre-requisite.

Students completing BIOL 190, practically speaking, do receive/earn a higher final course grade compared to those taking CHEM 121 in BIOL 223.

Discussion

In terms of WNC Nursing admission points, either end point (regardless of the completed pre-requisite course) is equal points (B vs B) on average. However, when comparing the average final course grade of the pre-requisite courses to passing or failing BIOL 223, students received/earned a substantially higher, albeit not statistically different, grade in BIOL 190, compared to CHEM 121; **that <u>will</u> have an impact** upon Nursing admission points for students (B v B-).

In discussion with colleagues, one matter/question arose: will there still be CHEM 121 students if WNC BIOL faculty remove CHEM 121 as a pre-req to BIOL 223? Although the answer is clearly "yes", a meta-analysis of CHEM 121 students by their degree/chosen field of study was examined from Spring 2012 through Spring 2019 (15 semesters) using, once, again, only the author's students as subjects, so as to, again, not step on other folks' toes to explore this topic.

As can be seen in **Appendix 2, Figure 3**, pre-nursing student enrollments in CHEM 121 <u>pre-2017-01</u> averaged in the area of 10 students per class. <u>Peri- and post-2017-01</u>, pre-nursing students are running about 3 students per class. While this is indicative/suggestive of guidance by either WNC Counselors or by the students, themselves, it remains to be discovered/clarified/verified/confirmed. What IS clear, however, is that pre-nursing students are being directed away from CHEM 121 in Carson City and, most likely, towards BIOL 190/L, which, for those students is in their very best interests for their optimal academic success. Ideally, in the very near future, only the pre-BSN students will be enrolled in BIOL 190 AND CHEM 121 for their transfer to UNR-Orvis; students aiming only for WNC's AAS-NURS will be enrolled in only BIOL 190 as their unique pre-requisite for A&P and Microbiology.

In addition, an interesting observation (phenomenon???) regarding BIOL 190/L and CHEM 121 was made by two BIOL/CHEM faculty members: 6-8 students who had completed CHEM 121 in a barely borderline passing manner who then completed BIOL 190 with the same faculty member actually came back to CHEM 121 with the same faculty member and turned their borderline performance in CHEM 121 around 180° to being remarkably successful (D's and F's to A's). Whether this is possibly due to faculty familiarity, student maturation, both of the above, or neither of the above, it, nevertheless, merits astute Counselors' attentions and faculty reporting upon in academic year 2019-2020.

It may very well be possible that in/for future student advisement that students will be advised that BIOL 190 needs to be completed prior to CHEM 121 antithetically to the intuitive (traditional), retro, approach of having students complete CHEM before BIOL. That this approach is possible and plausible may have some of its roots in a current national discussion regarding the sequence of CHEM 121 and CHEM 220. There are whispers that some institutions have found that students who complete CHEM 220 prior to CHEM 121 perform better in CHEM 121. Both will be interesting topics to follow further explore. Perhaps the pre-Linus Pauling approach to

General CHEM had some very valuable and considerable merit, after all, i.e., qualitative (conceptual) approaches may very well pre-empt quantitative (concrete) approaches.

Conclusion[s] and Implementation

Based upon the evidence, it's very clear that removing CHEM 121 as one of the pre-requisites to BIOL 223 is warranted, in the students' best interests and in alignment with WNC's Strategic Goal #1: Improve Student Success Rates.

WNC Full-Time BIOL/CHEM faculty have e-agreed to the proposed BIOL 223 pre-requisite changes per E-Subject Heading: BIOL 223 Pre-Requisite Assessment Report, May 2, 2019, 20:24 hours, May 2, 2019, 22:16 hours, May 2, 2019, 22:22 hours, May 20, 2019, 20:26 hours and May 2, 2019, 20:13 hours.

WNC's Curriculum Form is below in Appendix 3, Exhibit A, in accordance with WNC Policy 3-2-1, for Fall 2020 implementation. The proposed changes are considered submitted for proper command chain review for approval by the WNC Curriculum Committee upon this e-notification.

Lastly, a topic of immense importance at any institution of higher education is that of academic freedom. At WNC it's no less important. This proposal in no way, shape or form treads upon any other department's or division's academic freedom. Those departments are still well within their academic freedom rights to require that students complete CHEM 121 prior to acceptance/admission into their program[s] if they so desire; indeed, this author supports those departments'/divisions' academic freedom rights to do so, should they do so. Likewise, BIOL/CHEM faculty are within their academic freedom rights to propose and enforce these changes, upon Curriculum Committee approval, in their areas of expertise: data/evidence-based assessment once more.

Acknowledgements: This report would not have been as easily constructed/developed had it not been for Ms. Cathy Fulkerson, Director of WNC's Institutional Research. Her efforts have been wonderful and are so very much appreciated by this author!

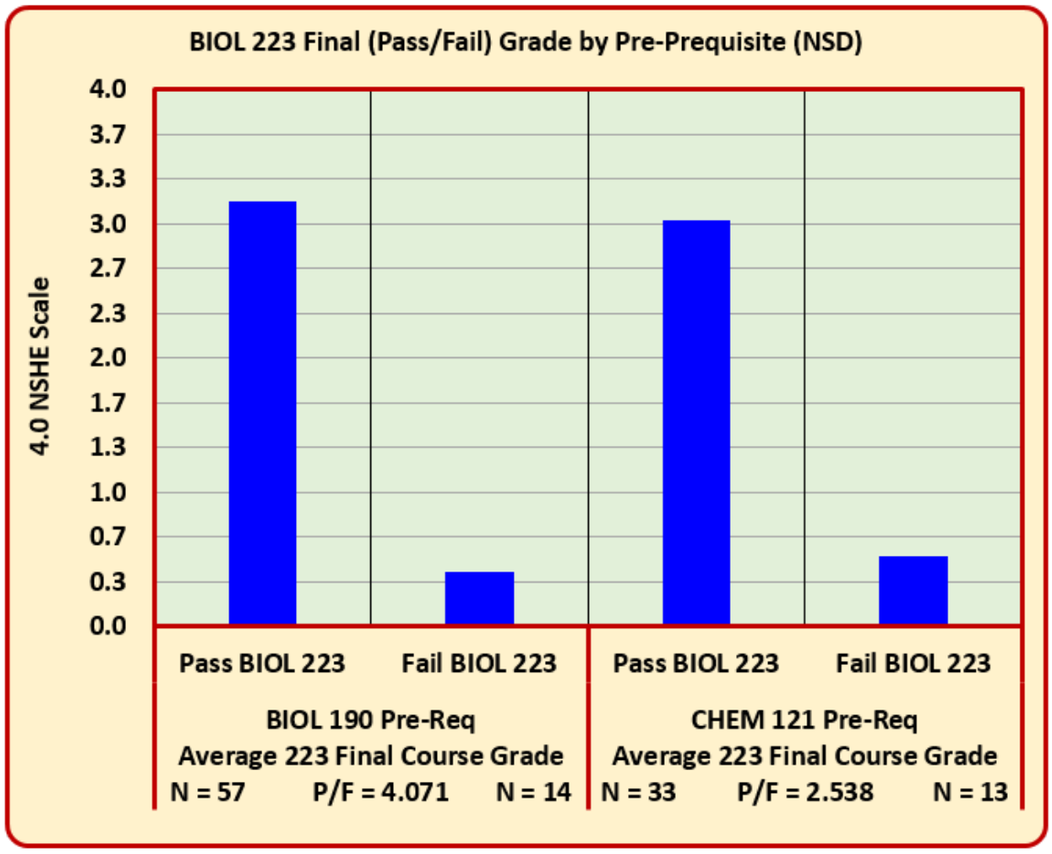
The author also acknowledges the Full-Time BIOL/CHEM faculty: Dr. Gary Evett, Professor of Biophysical Sciences, Dr. Elizabeth Tattersall, Professor of Biophysical Sciences, Dr. Smriti Bhattarai, Instructor of Biological Sciences and Ms. Rachelle Bassen, Instructor of Biological Sciences. Without your participation, this report would be gathering dust and our students would not be served as appropriately. Many, many thanks!

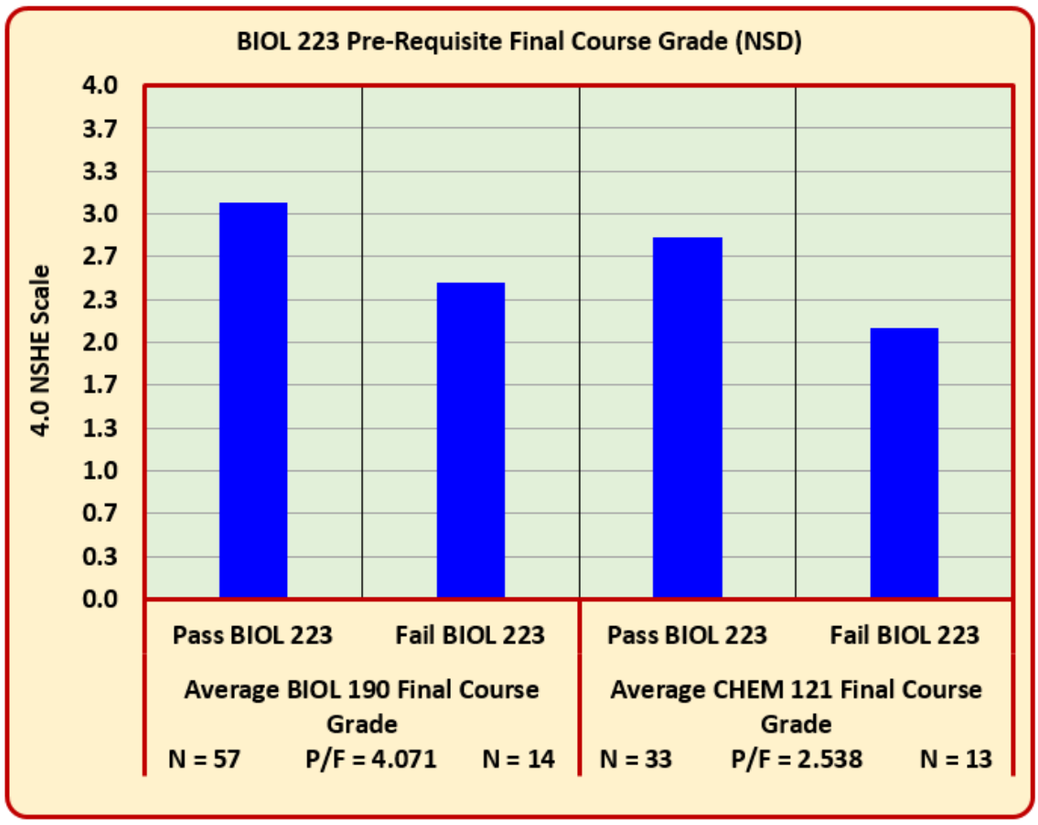
Appendix 1: Figure 1, top

Average Final Course Grades for BIOL 223 either post-BIOL 190/L (left hand side of graphic) or post-CHEM 121 (right hand side of graphic)

Appendix 1: Figure 2, bottom

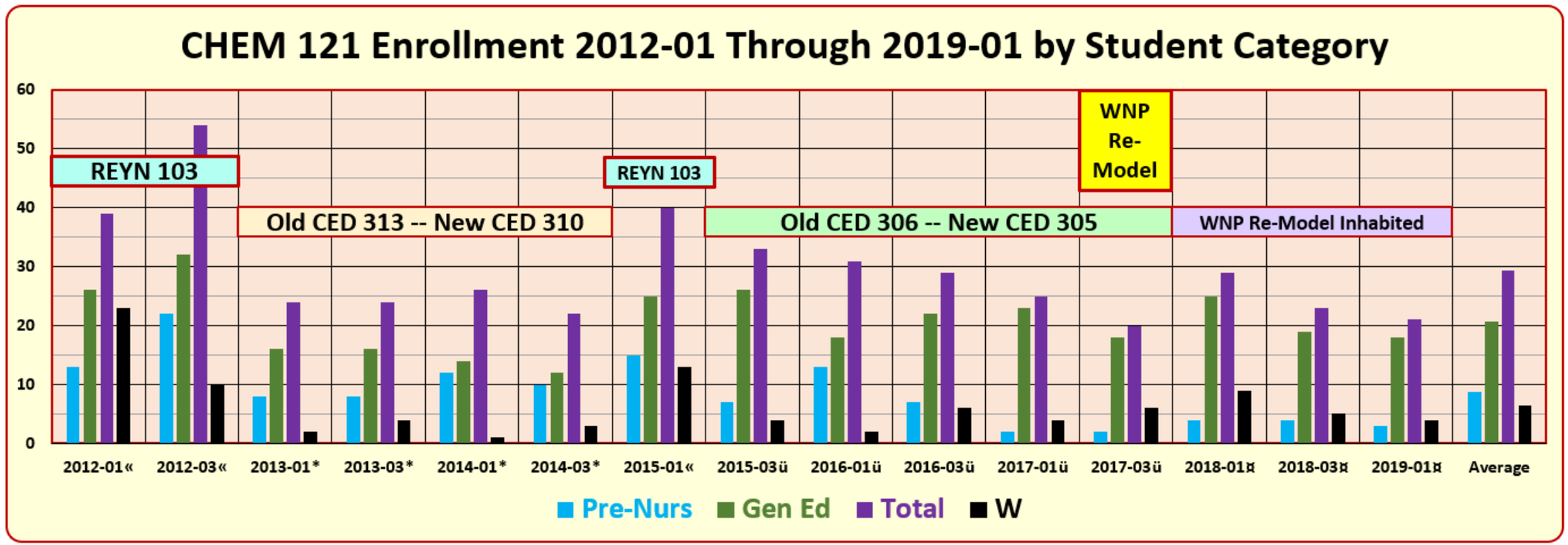
Average Final Pre-Requisite Course Grades for Students Matriculating BIOL 223 either post-BIOL 190/L (left hand side of graphic) or post-CHEM 121 (right hand side of graphic)


BIOL 223 Final (Pass/Fail) Grade by Pre-Prequisite (NSD)
4.0 NSHE Scale
4.0
3.7
3.3
3.0
2.7
2.3
2.0
1.7
1.3
1.0
0.7
0.3
0.0
Pass BIOL 223
Fail BIOL 223
Pass BIOL 223
Fail BIOL 223
BIOL 190 Pre-Req
Average 223 Final Course Grade
N = 57
P/F = 4.071
N = 14
CHEM 121 Pre-Req
Average 223 Final Course Grade
N = 33
P/F = 2.538
N = 13


BIOL 223 Pre-Requisite Final Course Grade (NSD)
4.0 NSHE Scale
4.0
3.7
3.3
3.0
2.7
2.3
2.0
1.7
1.3
1.0
0.7
0.3
0.0
Pass BIOL 223
Fail BIOL 223
Pass BIOL 223
Fail BIOL 223
Average BIOL 190 Final Course Grade
N = 57
P/F = 4.071
N = 14
Average CHEM 121 Final Course Grade
N = 33
P/F = 2.538
N = 13

Appendix 2: Figure 3

CHEM 121 Enrollments – 2012-01-2019-01 – Carson Campus ONLY – by Student Degree Field.


CHEM 121 Enrollment 2012-01 Through 2019-01 by Student Category
60
50
40
30
20
10
0
REYN 103
Old CED 313 -- New CED 310
REYN 103
Old CED 306 -- New CED 305
WNP Re-Model
WNP Re-Model Inhabited
2012-01«
2012-03«
2013-01*
2013-03*
2014-01*
2014-03*
2015-01«
2015-03ü
2016-01ü
2016-03ü
2017-01ü
2017-03ü
2018-01¤
2018-03¤
2019-01¤
Average
Pre-Nurs
Gen Ed
Total
W

Appendix 3: Exhibit A

WNC Articulation Form: Proposed BIOL 223 pre-requisite changes

Western Nevada College

Articulation Form

Date: _ 21 May 2019____ Semester for action to occur: _2020-03_____

Check one:
New course ___ Change to existing course _XXX__ Deactivate course ____ Reactivate course _____

Add Campus ____

Course prefix & number: ___BIOL 223_____ Credits __4____

If deactivating a course, STOP, the form is complete and ready for signatures and submission.

If change to existing WNC course, list change(s) requested:
Note: If title change, list a short title (25 character maximum) and long title (40 character maximum)

Change the current BIOL 223 pre-req statement …

FROM:
Prerequisites: BIOL 190 & BIOL 190L with a grade of C or better or CHEM 121 with a grade of C or better. May be repeated a maximum of two times within the last five years.

TO:
Prerequisites: BIOL 190 with a grade of C or better. May be repeated a maximum of two times within the last five years.

If new course, fill out the remainder of this form.

Short Title: _____(25 characters maximum)

Long Title: _____ (40 characters maximum)

Prerequisite(s): __ __

If credits can be repeated towards a degree/certificate, maximum number of credits: ____

Letter grade ____ or Pass/Fail ____ If cross-listed with another course, list other course: _____

Should the course be published in the WNC catalog? _Yes_____ Division: _Liberal Arts_____

For new courses:
a) It is strongly advised that you speak with or email your campus librarian so materials to support the course may be purchased (see articulation instructions for information).

b) A course outline must be attached (see WNC outline template for required information).

_____
Individual Submitting Form Date

Signing this document as Division Director confirms that all faculty who teach in this discipline or whose program will be affect by this course have been consulted and a consensus approves of this proposal.

_____
Liberal Arts Division Director Date

_____
VP of Academic & Student Affairs Date

_____
Articulation/Curriculum Chair Date

CIP Code _____ Entered by _____ Date Entered _____

11/19/07