Northern Oklahoma College
Mathematics and Physical Science Degree Program Review
Options: Astronomy, Chem/Physics, Mathematics, & Pre-Engineering
Program Assessment
Completed May 2017

Based on the thorough internal or external program review addressing all criteria in policy, a comprehensive report should be possible within ten or fewer pages. This program review template is provided to assist institutions in compiling the program review information, which is to be presented to the institutional governing board prior to submission to the State Regents. Executive Summaries should be possible within two pages using the provided template (Program Review Executive Summary Template).

Description of the program’s connection to the institutional mission and goals:

The mission of Northern Oklahoma College, the State’s oldest community college, is a multi-campus, land-grant institution that provides high quality, accessible, and affordable educational opportunities and services which create life-changing experiences and develop students as effective learners and leaders within their communities in a connected, ever-changing world.

Northern Oklahoma College will be recognized as a model institution and leader in academic quality and cultural enrichment, promoting student success, collaborative learning, creative and forward thinking, and community responsiveness.

The core values of Northern Oklahoma College are that through personalized education we believe in providing individualized services leading our students to achieve their academic goals in a welcoming and safe environment, and we will provide support to students in and out of the classroom so that they receive a full college experience with diverse opportunities. Another core value is community and civic engagement, so we believe that educated citizens are necessary for a healthy, democratic society, and that free and open expression and an appreciation for diversity are cornerstones of higher education, and we believe in economic and environmental sustainability and the importance of enriching the intellectual, artistic, economic, and social resources of our communities.

We at Northern Oklahoma College also believe in the inherent value of intellectual pursuit for both personal and professional growth, as well as the need to prepare students for the 21st century professions, and that a knowledge-centered institution is vital to a knowledge-based economy, and we measure our success against national models and standards of excellence.

3.7.5 Process (Internal/External Review):
Previous Reviews and Actions from those reviews:

Analysis and Assessment (including quantitative and qualitative measures) noting key findings from internal or external reviews and including developments since the last review:
2016-2017

Astronomy
- Purchased several upgrades for the Mackey Planetarium for better student learning opportunities.

Chem/Physics
- Modified semester offerings of CHEM 1014 Concepts of Chemistry to address the needs of multiple degree program.
- Added summer offerings of CHEM 1314 (Tonkawa).
- Added online offerings of PHSC 1114 General Physical Science to both Spring and Summer schedules.
- Added online sections of ESCI 1114 Earth Science to Summer schedule.

Mathematics
- Began offering a few pilot sections of College Algebra Supplement and Math Applications Supplement on all three campuses.
- Increasing the offerings of Calc I and II to meet the needs of students.

Pre-Engineering
- Switched semester offerings for ENGR 2433 Thermodynamics and ENGR 2113 Statics to better align with mathematics course offerings.
- Incorporated a multidiscipline aspect to ENGR 2111 Engineering Mechanics I.
- Began offering PHYS 2014 Engineering Physics I to Enid campus via ITV.
- Offered a summer section of Phys 2014 (Tonkawa) to support student to degree completion in a timely manner.
- Placed 3 engineering interns during the year.
- Began offering Physics research opportunities to students.

A. Centrality of the Program to the Institution’s Mission:

The mission of Northern Oklahoma College, the State’s oldest community college, is a multi-campus, land-grant institution that provides high quality, accessible, and affordable educational opportunities and services which create life-changing experiences and develop students as effective learners and leaders within their communities in a connected, ever-changing world. Students in the A.S. degree program meet general education needs and can specialize in 4 different areas aiding in smooth transfer in high demand degree areas for our region.

B. Vitality of the Program:

B.1. Program Objectives and Goals:

Students after completion of the Mathematics and Physical Science degree will be able to:

Mathematics and Physical Science

Astronomy
- Use and apply physical data to solve problems
- Use logical reasoning to solve problems
- Explain evolutionary theory and its supporting principles

**Chem/Physics**
- Use and apply physical data to solve problems
- Use logical reasoning to solve problems
- Communicate scientific ideas through technical writing
- Solve problems related to thermodynamics

**Mathematics**
- Sketch or identify and interpret graphs.
- Manipulate, simplify and/or solve expressions or equations.
- Solve and interpret real world application problems.

**Pre-Engineering**
- Use and apply physical data to solve problems
- Use logical reasoning to solve problems
- Communicate scientific ideas through technical writing
- Recognize connections between physical concepts and engineering applications

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**B.2 Quality Indicators (including Higher Learning Commission issues):**

**Mathematics and Physical Science**
No objectives determined yet

<table>
<thead>
<tr>
<th><strong>Astronomy</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Date</strong></td>
</tr>
<tr>
<td><strong>Competency # and Description</strong></td>
</tr>
</tbody>
</table>
| **Course**     | ASTR 2513 – Observatory Methods  
                 | MATH 2145 – Calculus I  
                 | MATH 2155 – Calculus II |
| **Activity**   | ASTR 2513 - Quiz  
                 | MATH 2145 – Word problems involving derivations  
                 | MATH 2155 – Word problems involving vectors. |
| **Measurement (attached copy of instrument with point distribution)** | ASTR 2513 - Quiz  
                                                                | MATH 2145 - Common questions assessed on a quiz  
                                                                | MATH 2155 - Common questions assessed on a quiz |
| **Evaluation Criteria** | ASTR 2513 - 70% pass rate on exam  
                                           | MATH 2145 - Students will earn 70% or better on the quiz  
                                           | MATH 2155 - Students will earn 70% or better on the quiz |
| **Last Semesters results** | ASTR 2513 - Not offered  
                                        | MATH 2145 - not collected  
<pre><code>                                    | MATH 2155 - not collected |
</code></pre>
<table>
<thead>
<tr>
<th>Results</th>
<th>ASTR 2513</th>
<th>Not offered</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MATH 2145</td>
<td>7/7 (100%) of students met competency</td>
</tr>
<tr>
<td></td>
<td>MATH 2155</td>
<td>31/35 (88.57%) of students met competency</td>
</tr>
<tr>
<td></td>
<td>MATH 2145</td>
<td>26/35 (74.28%) of students met competency</td>
</tr>
<tr>
<td></td>
<td>MATH 2155</td>
<td>4/7 (57.14%) of students met competency</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Summary of previous changes</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendation for changes</td>
<td>ASTR 2513 – NA</td>
</tr>
<tr>
<td></td>
<td>MATH - Conversation still in progress to be completed before fall course start.</td>
</tr>
<tr>
<td>Timeline for Review</td>
<td>Fall/spring data will be collected and reviews in the spring by instructors from all campuses will determine needed adjustments.</td>
</tr>
</tbody>
</table>

**Date** | 5/11/2017  
**Competency # and Description** | 2. Use logical reasoning to solve problems  
**Course** | ASTR 2513 – Observatory Methods  
| MATH 2145 – Calculus I  
| MATH 2155 – Calculus II  
**Activity** | ASTR 2513 - Quiz  
| MATH 2145 – Word problems involving derivations  
| MATH 2155 – Word problems involving vectors.  
**Measurement (attached copy of instrument with point distribution)** | ASTR 2513 - Quiz  
| MATH 2145 - Common questions assessed on a quiz  
| MATH 2155 - Common questions assessed on a quiz  
**Evaluation Criteria** | 70% pass rate on activity  
**Last Semesters results** | ASTR 2513 – Not offered  
| MATH 2145 – 103 out of 134 – 77%  
| MATH 2155 – 36 out of 39 – 92%  
**Results** | NA – ASTR 2513 not offered  
| MATH 2145 – 7/7 (100%) of students met competency  
| MATH 2155 – 31/35 (88.57%) of students met competency  
| MATH 2145 – 26/35 (74.28%) of students met competency  
| MATH 2155 – 4/7 (57.14%) of students met competency  
| **Summary of previous changes** | NA  
| **Recommendation for changes** | ASTR - NA  
| MATH - Conversation still in progress to be completed before fall course start.  
| **Timeline for Review** | Fall/spring data will be collected and reviews in the spring by instructors from all campuses will determine needed adjustments.  


<table>
<thead>
<tr>
<th>Date</th>
<th>5/11/2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competency # and Description</td>
<td>3. Explain evolutionary theory and its supporting principles.</td>
</tr>
<tr>
<td>Course</td>
<td>ASTR 1523 – Planetary Science</td>
</tr>
<tr>
<td>Activity</td>
<td>ASTR 1523 - Exam</td>
</tr>
<tr>
<td>Measurement (attached copy of instrument with point distribution)</td>
<td>ASTR 1523 - Exam</td>
</tr>
<tr>
<td>Evaluation Criteria</td>
<td>Pass rate of 70% on each activity</td>
</tr>
<tr>
<td>Last Semesters results</td>
<td>ASTR 1523 15 out of 15 – 100%</td>
</tr>
<tr>
<td>Results</td>
<td>ASTR 1523 17 out of 17 – 100%</td>
</tr>
<tr>
<td>Summary of previous changes</td>
<td>Added moon, Mars and Io</td>
</tr>
<tr>
<td>Recommendation for changes</td>
<td>Next year will include Mercury</td>
</tr>
<tr>
<td>Timeline for Review</td>
<td>Fall/spring data will be collected and reviews in the spring by instructors from all campuses will determine needed adjustments.</td>
</tr>
</tbody>
</table>

**Chem/Physics**

<table>
<thead>
<tr>
<th>Date</th>
<th>5/11/2017</th>
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</thead>
<tbody>
<tr>
<td>Competency # and Description</td>
<td>4. Use and apply physical data to solve problems</td>
</tr>
</tbody>
</table>
| Course     | CHEM 1414 – General Chemistry II  
PHYS 2014 – Engineering Physics I  
MATH 2145 – Calculus I  
MATH 2155 – Calculus II |
| Activity   | CHEM 1414 – Quizzes, exams  
PHYS 2014 - Quizzes, exams  
MATH 2145 – Word problems involving derivations  
MATH 2155 – Word problems involving vectors. |
| Measurement (attached copy of instrument with point distribution) | CHEM 1414 – Quizzes, exams  
PHYS 2014 – Quizzes, exams  
MATH 2145 - Common questions assessed on a quiz  
MATH 2155 - Common questions assessed on a quiz |
<p>| Evaluation Criteria | 70% pass rate on exam |</p>
<table>
<thead>
<tr>
<th>Last Semesters results</th>
<th>CHEM 1414 31 out of 44 – 70.5%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PHYS 2014 14 out of 20 – 70.0%</td>
</tr>
<tr>
<td></td>
<td>MATH 2145 not collected</td>
</tr>
<tr>
<td></td>
<td>MATH 2155 not collected</td>
</tr>
</tbody>
</table>

| Results | CHEM 1414 39 out of 51 – 76.5% |
|         | PHYS 2014 25 out of 25 – 100%  |
|         | MATH 2145 – 7/7 (100%) of students met competency |
|         | MATH 2155 – 31/35 (88.57%) of students met competency |
|         | MATH 2145 – 26/35 (74.28%) of students met competency |
|         | MATH 2155 – 4/7 (57.14%) of students met competency |

| Summary of previous changes | Math faculty have added this assessment to their overall program assessment and courses will be assessed for the following spring. |
|                            | Science - No changes made in previous year. |
|                            | Recommendation for changes Science - Use the same set of questions along with a rubric for scoring. |
|                            | Math - Conversation still in progress to be completed before fall course start. |
|                            | Timeline for Review Fall/spring data will be collected and reviews in the spring by instructors from all campuses will determine needed adjustments. |

<table>
<thead>
<tr>
<th>Date</th>
<th>5/11/2017</th>
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</thead>
<tbody>
<tr>
<td>Competency # and Description</td>
<td>5. Use logical reasoning to solve problems</td>
</tr>
<tr>
<td>Course</td>
<td>CHEM 1414 – General Chemistry II</td>
</tr>
<tr>
<td></td>
<td>PHYS 2014 – Engineering Physics I</td>
</tr>
<tr>
<td></td>
<td>MATH 2145 – Calculus I</td>
</tr>
<tr>
<td></td>
<td>MATH 2155 – Calculus II</td>
</tr>
<tr>
<td>Activity</td>
<td>CHEM 1414 – Quizzes, exams</td>
</tr>
<tr>
<td></td>
<td>PHYS 2014 - Quizzes, exams</td>
</tr>
<tr>
<td></td>
<td>MATH 2145 – Word problems involving derivations</td>
</tr>
<tr>
<td></td>
<td>MATH 2155 – Word problems involving vectors.</td>
</tr>
<tr>
<td>Measurement (attached copy of instrument with point distribution)</td>
<td>CHEM 1414 – Quizzes, exams</td>
</tr>
<tr>
<td></td>
<td>PHYS 2014 - Quizzes, exams</td>
</tr>
<tr>
<td></td>
<td>MATH 2145 - Common questions assessed on a quiz</td>
</tr>
<tr>
<td></td>
<td>MATH 2155 - Common questions assessed on a quiz</td>
</tr>
<tr>
<td>Evaluation Criteria</td>
<td>70% pass rate on exam</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Last Semesters results</th>
<th>CHEM 1414 28 out of 45 – 62.2%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PHYS 2014 14 out of 20 – 70.0%</td>
</tr>
<tr>
<td></td>
<td>MATH 2145 103 out of 134 – 77%</td>
</tr>
<tr>
<td></td>
<td>MATH 2155 36 out of 39 – 92%</td>
</tr>
</tbody>
</table>

<p>| Results | CHEM 1414 38 out of 55 – 69.1% |
|         | PHYS 2014 25 out of 25 – 100%  |</p>
<table>
<thead>
<tr>
<th>Date</th>
<th>5/11/2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competency # and Description</td>
<td>6. Communicate scientific ideas through technical writing</td>
</tr>
</tbody>
</table>
| Course     | CHEM 1414 – General Chemistry II  
PHYS 2014 – Engineering Physics I |
| Activity   | CHEM 1414 - Labs  
PHYS 2014 - Labs |
| Measurement (attached copy of instrument with point distribution) | CHEM 1414 - Labs  
PHYS 2014 - Labs |
| Evaluation Criteria | Pass rate of 70% on each activity |
| Last Semesters results | CHEM 1414 39 out of 40 – 97.5%  
PHYS 2014 17 out of 20 – 85.0% |
| Results    | CHEM 1414 44 out of 53 – 83.0%  
PHYS 2014 26 out of 28 – 92.8% |
<p>| Summary of previous changes | No changes for previous year. |
| Recommendation for changes | Have students take lab notes and turn these in with the lab report. |
| Timeline for Review | Fall/spring data will be collected and reviews in the spring by instructors from all campuses will determine needed adjustments. |</p>
<table>
<thead>
<tr>
<th>Activity</th>
<th>CHEM 1414 – Quiz, exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement (attached copy of instrument with point distribution)</td>
<td>CHEM 1414 – Quiz, exam</td>
</tr>
<tr>
<td>Evaluation Criteria</td>
<td>Pass rate of 70% on each activity</td>
</tr>
<tr>
<td>Last Semesters results</td>
<td>CHEM 1414     34 out of 45 – 76%</td>
</tr>
<tr>
<td>Results</td>
<td>CHEM 1414     46 out of 53 - 86.8%</td>
</tr>
<tr>
<td>Summary of previous changes</td>
<td>No changes to previous year.</td>
</tr>
<tr>
<td>Recommendation for changes</td>
<td>Use a specific quiz for thermo assessment using a rubric for scoring.</td>
</tr>
<tr>
<td>Timeline for Review</td>
<td>Fall/spring data will be collected and reviews in the spring by instructors from all campuses will determine needed adjustments.</td>
</tr>
</tbody>
</table>

## Mathematics

**Date**: 5/23/2017

### Competency # and Description

1. Sketch or identify and interpret graphs

### Course

<table>
<thead>
<tr>
<th>MATH 1613 - Trigonometry</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 2145 – Calculus I</td>
</tr>
<tr>
<td>MATH 2155 – Calculus II</td>
</tr>
</tbody>
</table>

### Activity

| MATH 1613 – Identify amplitude, period and sketch graph of the 6 trig functions |
| MATH 2145 – Discuss the continuity of a given function at a point and on an interval |
| MATH 2155 – Find the second derivative, slope of the tangent line and the y direction of a point of a function |

### Measurement (attached copy of instrument with point distribution)

| MATH 1613 - Common question assessed on quiz |
| MATH 2145 - Common question assessed on quiz |
| MATH 2155 - Common question assessed on quiz |

### Evaluation Criteria

| MATH 1613 - Students will earn 70% or better on quiz |
| MATH 2145 - Students will earn 70% or better on quiz |
| MATH 2155 - Students will earn 70% or better on quiz |

### Last Semesters results

| MATH 1613 – 75/94 (79.79%) of students met competency |
| MATH 2145 – 17/22 (77.27%) of students met competency |
| MATH 2155 – 12/18 (66.67%) of students met competency |

| MATH 1613 – 70/94 (74.47%) of students met competency |
| MATH 2145 – 39/46 (84.78%) of students met competency |
| MATH 2155 – 14/20 (70.00%) of students met competency |
### Results

- MATH 1613 – 39/49 (79.59%) of students met competency
- MATH 2145 – 9/9 (100%) of students met competency
- MATH 2155 – 27/35 (77.14%) of students met competency
- MATH 1613 – 27/35 (77.14%) of students met competency
- MATH 2155 – 6/7 (85.71%) of students met competency

### Summary of previous changes

- Trig - stay as is – critical for content mastery needed for calculus
- Calculus I – graph remains, but students write info regarding graphs with no hints given
- Calculus II – some rewording – polar coordinates, answers moved to rubric design

### Recommendation for changes

Conversation still in progress to be completed before fall course start.

### Timeline for Review

Fall/spring data will be collected and reviews in the spring by instructors from all campuses will determine needed adjustments.

### Date

5/23/2017

### Competency # and Description

2. Manipulate, simplify and/or solve expressions or equations

### Course

- MATH 1613 - Trigonometry
- MATH 2145 – Calculus I
- MATH 2155 – Calculus II
- MATH 2613 – Differential Equations

### Activity

- MATH 1613 – Verify each identity justifying each step
- MATH 2145 – Fundamental rules of integration.
- MATH 2155 – Evaluate and apply double and triple integrals in rectangular and polar coordinates
- MATH 2613 – Solve various type of equations including Laplace transforms and determining if an equation is exact.

### Measurement (attached copy of instrument with point distribution)

- MATH 1613 - Common questions assessed on a quiz
- MATH 2145 - Common questions assessed on a quiz
- MATH 2155 - Common questions assessed on a quiz
- MATH 2613 - Common questions assessed on a quiz

### Evaluation Criteria

- MATH 1613 - Students will earn 70% or better on the quiz
- MATH 2145 - Students will earn 70% or better on the quiz
- MATH 2155 - Students will earn 70% or better on the quiz
- MATH 2613 - Students will earn 70% or better on the quiz

### Last Semesters results

- MATH 1613 – 68/92 (73.91%) of students met competency
- MATH 2145 – 18/22 (81.82%) of students met competency
- MATH 2155 – 15/22 (68.18%) of students met competency
- MATH 2613 – 17/19 (89.47%) of students met competency
- MATH 1613 – 12/12 (100%) of students met competency
- MATH 2145 – 33/43 (76.74%) of students met competency
- MATH 2155 – 19/20 (95%) of students met competency
- MATH 2613 – 13/19 (68.2%) and 11/19 (57.89%)
### Results

<table>
<thead>
<tr>
<th>Course</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1613</td>
<td>20/30 (66.67%) of students met competency</td>
</tr>
<tr>
<td>MATH 2145</td>
<td>7/9 (77.78%) of students met competency</td>
</tr>
<tr>
<td>MATH 2155</td>
<td>30/35 (85/71%) of students met competency</td>
</tr>
<tr>
<td>MATH 2613</td>
<td>N/A</td>
</tr>
<tr>
<td>MATH 1613</td>
<td>N/A</td>
</tr>
<tr>
<td>MATH 2145</td>
<td>6/7 (85.71%) of students met competency</td>
</tr>
<tr>
<td>MATH 2155</td>
<td>24/35 (68.75%) of students met competency</td>
</tr>
<tr>
<td>MATH 2613</td>
<td>21/28 (75%) of students met competency</td>
</tr>
</tbody>
</table>

### Summary of previous changes

A rubric will be created for trig and possible addition of short answer. Possible rewording of instructions. A rubric will be added to differential equations. No changes for the calculus courses.

### Recommendation for changes

Conversation still in progress to be completed before fall course start.

### Timeline for Review

Fall/spring data will be collected and reviews in the spring by instructors from all campuses will determine needed adjustments.

### Date

5/23/2017

### Competency # and Description

3. Solve and interpret real world application problems

### Course

| MATH 1613 - Trigonometry |
| MATH 2155 - Calculus II |

### Activity

| MATH 1613 – Word problems involving trig functions |
| MATH 2155 – Word problems involving vectors. |

### Measurement (attached copy of instrument with point distribution)

| MATH 1613 - Common questions assessed on a quiz |
| MATH 2155 - Common questions assessed on a quiz |

### Evaluation Criteria

| MATH 1613 - Students will earn 70% or better on the quiz |
| MATH 2155 - Students will earn 70% or better on the quiz |

### Last Semesters results

| MATH 1613 – 72/87 (82.73%) |
| MATH 2155 – 17/19 (89.47%) |
| MATH 1613 – 74/89 (83.15%) |
| MATH 2155 – 16/20 (80.00%) |

### Results

| MATH 1613 – 39/48 (81.25%) of students met competency |
| MATH 2145 – 7/7 (100%) of students met competency |
| MATH 2155 – 31/35 (88.57%) of students met competency |
| MATH 1613 – N/A |
| MATH 2145 – 26/35 (74.29%) of students met competency |
| MATH 2155 – 4/7 (57.14%) of students met competency |

### Summary of previous changes

Trig assessment will be redone to apply Law of Sines and Law of Cosines. This will be implemented Spring 2017. Calculus rubric added and no class hint for students. Real world questions will be added for addition to other Physical Science degree options.
**Recommendation for changes**

Conversation still in progress to be completed before fall course start.

**Timeline for Review**

Fall/spring data will be collected and reviews in the spring by instructors from all campuses will determine needed adjustments.

<table>
<thead>
<tr>
<th>Date</th>
<th>5/23/2017</th>
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<tbody>
<tr>
<td>Competency # and Description</td>
<td>4. Use and apply physical data to solve problems</td>
</tr>
</tbody>
</table>
| Course     | MATH 2145 – Calculus I  
MATH 2155 – Calculus II |
| Activity   | MATH 1613 – Word problems involving trig functions  
MATH 2145 – Word problems involving derivations  
MATH 2155 – Word problems involving vectors. |
| Measurement (attached copy of instrument with point distribution) | MATH 2145 - Common questions assessed on a quiz  
MATH 2155 - Common questions assessed on a quiz |
| Evaluation Criteria | MATH 2145 - Students will earn 70% or better on the quiz  
MATH 2155 - Students will earn 70% or better on the quiz |
| Last Semesters results | N/A |
| Results    | MATH 2145 – 7/7 (100%) of students met competency  
MATH 2155 – 31/35 (88.57%) of students met competency  
MATH 2145 – 26/35 (74.28%) of students met competency  
MATH 2155 – 4/7 (57.14%) of students met competency |
| Summary of previous changes | N/A |
| Recommendation for changes | Conversation still in progress to be completed before fall course start. |
| Timeline for Review | Fall/spring data will be collected and reviews in the spring by instructors from all campuses will determine needed adjustments. |
| Evaluation Criteria | MATH 2145 - Students will earn 70% or better on the quiz  
MATH 2155 - Students will earn 70% or better on the quiz |
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Last Semesters results</td>
<td>N/A</td>
</tr>
</tbody>
</table>
| Results | MATH 2145 – 7/7 (100%) of students met competency  
MATH 2155 – 31/35 (88.57%) of students met competency  
MATH 2145 – 26/35 (74.28%) of students met competency  
MATH 2155 – 4/7 (57.14%) of students met competency |
| Summary of previous changes | N/A |
| Recommendation for changes | Conversation still in progress to be completed before fall course start. |
| Timeline for Review | Fall/spring data will be collected and reviews in the spring by instructors from all campuses will determine needed adjustments. |

**Biological Science Degree – Pre-Pharmacy Option**

| Date | 5/23/2017 |
| Competency # and Description | 6. Demonstrate effective implementation of the scientific method and written and oral expression of scientific concepts and data. |
| Course | MATH 2103 – Elementary Calculus |
| Activity | MATH 2145 – Word problems involving derivations  
MATH 2155 – Word problems involving vectors. |
| Measurement (attached copy of instrument with point distribution) | MATH 2145 - Common questions assessed on a quiz  
MATH 2155 - Common questions assessed on a quiz |
| Evaluation Criteria | MATH 2145 - Students will earn 70% or better on the quiz  
MATH 2155 - Students will earn 70% or better on the quiz |
| Last Semesters results | N/A |
| Results | MATH 2103 – 12/15 (80%) of students met competency |
| Summary of previous changes | N/A |
| Recommendation for changes | Conversation still in progress to be completed before fall course start. |
| Timeline for Review | Fall/spring data will be collected and reviews in the spring by instructors from all campuses will determine needed adjustments. |

**Pre-Engineering**

12
<table>
<thead>
<tr>
<th>Date</th>
<th>5/15/2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competency # and Description</td>
<td>1. Use and apply physical data to solve problems</td>
</tr>
</tbody>
</table>
| Course       | PHYS 2014 – Engineering Physics I  
PHYS 2114 – Engineering Physics II  
MATH 2145 – Calculus I  
MATH 2155 – Calculus II |
| Activity     | PHYS 2014 - Quizzes, exams  
PHYS 2114 – Quizzes, exams  
MATH 2145 – Word problems involving derivations  
MATH 2155 – Word problems involving vectors. |
| Measurement (attached copy of instrument with point distribution) | PHYS 2014 - Quizzes, exams  
PHYS 2114 – Quizzes, exams  
MATH 2145 - Common questions assessed on a quiz  
MATH 2155 - Common questions assessed on a quiz |
| Evaluation Criteria | 70% pass rate on exam |
| Last Semesters results | PHYS 2014 14 out of 20 – 70.0%  
PHYS 2114 4 out of 5 – 80.0%  
MATH 2145 not collected  
MATH 2155 not collected |
| Results       | PHYS 2014 25 out of 25 – 100%  
PHYS 2114 18 out of 20 – 90%  
MATH 2145 – 7/7 (100%) of students met competency  
MATH 2155 – 31/35 (88.57%) of students met competency  
MATH 2145 – 26/35 (74.28%) of students met competency  
MATH 2155 – 4/7 (57.14%) of students met competency |
| Summary of previous changes | Math faculty have added this assessment to their overall program assessment and courses will be assessed for the following spring. |
| Recommendation for changes | Science - No changes at this time  
Math - Conversation still in progress to be completed before fall course start. |
| Timeline for Review | Fall/spring data will be collected and reviews in the spring by instructors from all campuses will determine needed adjustments. |

<table>
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<tr>
<th>Date</th>
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<tbody>
<tr>
<td>Competency # and Description</td>
<td>2. Use logical reasoning to solve problems</td>
</tr>
</tbody>
</table>
| Course       | PHYS 2014 – Engineering Physics I  
PHYS 2114 – Engineering Physics II  
MATH 2145 – Calculus I  
MATH 2155 – Calculus II |
| Activity          | PHYS 2014 - Quizzes, exams  
PHYS 2114 – Quizzes, exams  
MATH 2145 – Word problems involving derivations  
MATH 2155 – Word problems involving vectors. |
|-------------------|------------------------------------------------------------------|
| Measurement       | PHYS 2014 - Quizzes, exams  
PHYS 2114 – Quizzes, exams  
MATH 2145 - Common questions assessed on a quiz  
MATH 2155 - Common questions assessed on a quiz |
| Evaluation Criteria| 70% pass rate on exam                                           |
| Last Semesters results | PHYS 2014     14 out of 20 – 70.0%  
PHYS 2114     4 out of 5 – 80.0%  
MATH 2145     103 out of 134 – 77%  
MATH 2155     36 out of 39 – 92% |
| Results           | PHYS 2014     25 out of 25 – 100%  
PHYS 2114     18 out of 20 – 90%  
MATH 2145 – 7/7 (100%) of students met competency  
MATH 2155 – 31/35 (88.57%) of students met competency |
|                   | MATH 2145 – 26/35 (74.28%) of students met competency  
MATH 2155 – 4/7 (57.14%) of students met competency |
| Summary of previous changes | None made                        |
| Recommendation for changes | Science - No changes at this time.          
Math - Conversation still in progress to be completed before fall course start. |
| Timeline for Review | Fall/spring data will be collected and reviews in the spring by instructors from all campuses will determine needed adjustments. |

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<th>Date</th>
<th>5/15/2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competency # and Description</td>
<td>3. Communicate scientific ideas through technical writing</td>
</tr>
</tbody>
</table>
| Course | PHYS 2014 – Engineering Physics I  
PHYS 2114 – Engineering Physics II |
| Activity | PHYS 2014 – Lab  
PHYS 2114 - Lab |
| Measurement (attached copy of instrument with point distribution) | PHYS 2014 – Lab  
PHYS 2114 - Lab |
| Evaluation Criteria | Pass rate of 70% on each activity |
| Last Semesters results | PHYS 2014     17 out of 20 – 85.0%  
PHYS 2114     4 out of 5 – 80.0% |
<table>
<thead>
<tr>
<th>Results</th>
<th>PHYS 2014</th>
<th>26 out of 28 – 92.8%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PHYS 2114</td>
<td>18 out of 20 – 90%</td>
</tr>
<tr>
<td>Summary of previous</td>
<td>None made</td>
<td></td>
</tr>
<tr>
<td>changes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommendation for</td>
<td>No changes at this time.</td>
<td></td>
</tr>
<tr>
<td>changes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timeline for Review</td>
<td>Fall/spring data will be collected and reviews in the spring by instructors from all campuses will determine needed adjustments.</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>5/15/2017</td>
<td></td>
</tr>
<tr>
<td>Competency # and Description</td>
<td>4. Recognize connections between physical concepts and engineering applications</td>
<td></td>
</tr>
<tr>
<td>Course</td>
<td>PHYS 2014 – Engineering Physics I</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PHYS 2114 – Engineering Physics II</td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>PHYS 2014 – Assignments, exam</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PHYS 2114 – Assignments, exam</td>
<td></td>
</tr>
<tr>
<td>Measurement (attached</td>
<td>PHYS 2014 – Assignments, exam</td>
<td></td>
</tr>
<tr>
<td>copy of instrument with</td>
<td>PHYS 2114 – Assignments, exam</td>
<td></td>
</tr>
<tr>
<td>point distribution)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluation Criteria</td>
<td>Pass rate of 70% on each activity</td>
<td></td>
</tr>
<tr>
<td>Last Semesters results</td>
<td>PHYS 2014</td>
<td>not collected</td>
</tr>
<tr>
<td></td>
<td>PHYS 2114</td>
<td>4 out of 5 – 80.0%</td>
</tr>
<tr>
<td>Results</td>
<td>PHYS 2014</td>
<td>not collected</td>
</tr>
<tr>
<td></td>
<td>PHYS 2114</td>
<td>18 out of 20 – 90%</td>
</tr>
<tr>
<td>Summary of previous</td>
<td>None made</td>
<td></td>
</tr>
<tr>
<td>changes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommendation for</td>
<td>No changes at this time.</td>
<td></td>
</tr>
<tr>
<td>changes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timeline for Review</td>
<td>Fall/spring data will be collected and reviews in the spring by instructors from all campuses will determine needed adjustments.</td>
<td></td>
</tr>
</tbody>
</table>

**B.3. Minimum Productivity Indicators:**

<table>
<thead>
<tr>
<th>Time Frame (e.g.: 5 year span)</th>
<th>Head Count/Graduates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics and Physical Sci</td>
<td>0/0</td>
</tr>
<tr>
<td>Astronomy</td>
<td>0/1</td>
</tr>
<tr>
<td>Chem/Physics</td>
<td>10/3</td>
</tr>
<tr>
<td>Mathematics</td>
<td>24/8</td>
</tr>
</tbody>
</table>
B.4. Other Quantitative Measures:

a. Number of courses taught exclusively for the major program for each of the last five years and the size of classes:

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Name</th>
<th>Sections/Average Size of Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTR 1523</td>
<td>Planetary Science</td>
<td>1/22</td>
</tr>
<tr>
<td>ASTR 2513</td>
<td>Observatory Methods</td>
<td>0</td>
</tr>
<tr>
<td>MATH 2145</td>
<td>Calculus I</td>
<td>3/16</td>
</tr>
<tr>
<td>MATH 2155</td>
<td>Calculus II</td>
<td>2/10</td>
</tr>
<tr>
<td>MATH 2613</td>
<td>Differential Equations</td>
<td>1/9</td>
</tr>
<tr>
<td>PHYS 2014</td>
<td>Engineering Physics I</td>
<td>1/26</td>
</tr>
<tr>
<td>PHYS 2114</td>
<td>Engineering Physics II</td>
<td>1/12</td>
</tr>
</tbody>
</table>

b. Student credit hours by level generated in all major courses that make up the degree program for five years:

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Name</th>
<th>Hours Generated</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTR 1523</td>
<td>Planetary Science</td>
<td>66</td>
</tr>
<tr>
<td>ASTR 2513</td>
<td>Observatory Methods</td>
<td>0</td>
</tr>
<tr>
<td>MATH 2145</td>
<td>Calculus I</td>
<td>240</td>
</tr>
<tr>
<td>MATH 2155</td>
<td>Calculus II</td>
<td>100</td>
</tr>
<tr>
<td>MATH 2613</td>
<td>Differential Equations</td>
<td>27</td>
</tr>
<tr>
<td>PHYS 2014</td>
<td>Engineering Physics I</td>
<td>104</td>
</tr>
<tr>
<td>PHYS 2114</td>
<td>Engineering Physics II</td>
<td>48</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>585</td>
</tr>
</tbody>
</table>

c. Direct instructional costs for the program for the review period:
The program cost for the degree and options with salary and fringe benefits was $4812 average per 3-credit hour class taught.

$4812 \times 15 \text{ sections of 3 credit hour courses} = $72,180

$6416 \times 10 \text{ sections of 4-credit hour courses} = $64,160

$8020 \times 23 \text{ sections of 5-credit hour courses} = $184,460

Total Instructional Cost for Offering Program Courses: $320,800

d. The number of credits and credit hours generated in the program that support the general education component and other major programs including certificates:

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Name</th>
<th>Hours Generated</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1414</td>
<td>General Chemistry II</td>
<td>240</td>
</tr>
<tr>
<td>PHYS 1114</td>
<td>General Physics I</td>
<td>184</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>424</td>
</tr>
</tbody>
</table>

e. A roster of faculty members, faculty credentials and faculty credential institution(s). Also include the number of full time equivalent faculty in the specialized courses within the curriculum:

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Credential</th>
<th>Institution that granted degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dee Cooper (Calc)</td>
<td>Master of Education plus hours in math</td>
<td>Southwestern Oklahoma State</td>
</tr>
<tr>
<td>Jack Cnossen (Chem)</td>
<td>PhD in Chemical Engineering</td>
<td>Worcester Polytechnic Institute</td>
</tr>
<tr>
<td>Mary Ann Harris (Chem)</td>
<td>PhD in Animal Sciences</td>
<td>University of Arizona</td>
</tr>
<tr>
<td>Christi Hook (Calc/Diffi)</td>
<td>MS in Mathematics</td>
<td>Chadron State College</td>
</tr>
<tr>
<td>Lisa McGaw (Chem)</td>
<td>MS in Chemistry</td>
<td>Texas A &amp; M</td>
</tr>
<tr>
<td>Charmaine Munro (Chem/Phys)</td>
<td>PhD in Chemistry</td>
<td>Oklahoma State University</td>
</tr>
<tr>
<td>Darrel Negelein (Chem)</td>
<td>MS in Chemistry</td>
<td>University of Oklahoma</td>
</tr>
<tr>
<td>Kristi Orr (Calc)</td>
<td>MEd in Mathematics</td>
<td>University of North Dakota</td>
</tr>
<tr>
<td>Fritz Osell (Astr)</td>
<td>MEd in Ed Tech and graduate work in Geology/Oceanography</td>
<td>University of Hawaii</td>
</tr>
<tr>
<td>Frankie Wood-Black (Chem/Physics)</td>
<td>PhD in Physics</td>
<td>Oklahoma State University</td>
</tr>
</tbody>
</table>

*12 additional fte faculty teach general education math courses.
B.5.b. Detail demand for students produced by the program, taking into account employer demands, demands for skills of graduates, and job placement data:

This degree enables students to declare that they have an associate’s degree when applying for various employment, which according to recent College Study Board data increases earning potential by 13%.

While the associate degree is intended as a transfer degree, students who continue on to receive a bachelor’s or master’s degree may pursue careers such as actuaries, statisticians, education, engineer, or architect.

According to US Bureau of Labor statistics:
With an Associate’s Degree, the median pay in 2012 for civil, electrical, and mechanical engineering technicians ranged from $47,500-$57,900. There is little to no growth in the job outlook for engineering technicians.
With a Bachelor’s Degree, the median pay in 2012 for civil, mechanical, electrical or chemical engineers ranged from $80,000-$95,000. While petroleum engineers earned a median pay of $130,000. The job outlook for civil, mechanical, electrical or chemical engineers is about 5%, while petroleum engineers is about 26% growth.
With a Bachelor’s degree the median pay in 2012 for a high school teacher is $55,000 and post-secondary is $68,900. Job outlook is expected to grow by 6% for high school teachers (higher in certain areas) and 19% for post-secondary.
With a Master’s Degree, the median pay in 2012 for a mathematician was $101,300 and a statistician was $75,500. Job outlook is expected to grow by 23-27% for mathematicians and statisticians.

2016-2025 OK labor market projections

**Actuary - Bachelor's Degree**
Median Salary - $38.90/hr.
Growth - 15%
10 year change in jobs - 19

**Architect - Bachelor's Degree**
Median Salary - $33.73/hr.
Growth - %
10 year change in jobs - 4

**Math or Science Teacher- Bachelor's Degree**
Median Salary - $23.80/hr
Growth - 5%
10 year change in jobs - 47

**Mechanical Engineer - Bachelor's Degree**
Median Salary - $37.95/hr.
Growth - 12%
10 year change in jobs - 301

**Institutional Program Recommendations**: (describe detailed recommendations for the program as a result of this thorough review and how these recommendations will be implemented, as well as the timeline for key elements)

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Implementation Plan</th>
<th>Target Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2016-2017</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Astronomy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Evaluate the number of graduates in the degree program to determine feasibility of retaining the program area.</td>
<td>Annual review</td>
<td>2018</td>
</tr>
<tr>
<td><strong>Chem/Physics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Pursue more online and evening offerings of course for non-traditional students.</td>
<td>Annual review</td>
<td>2018</td>
</tr>
<tr>
<td>- Design program options for different workforce areas.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Assess the needs of adding course offerings in the subjects areas of circuits, concepts of physics (online) and a General, Organic, Biochemistry (GOB) course.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mathematics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Increase the offerings of Supplement offerings to more full scale.</td>
<td>Annual review</td>
<td>2018</td>
</tr>
<tr>
<td>- Begin work on new remedial course to replace concepts and intermediate to prepare for college algebra to implement fall 2018.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Continue to watch Calculus numbers to gauge the need for offering both each semester.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Start offering Supplement to Math Functions fall 2017.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Offer Math Functions on all campuses when degree requirements make changes.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Pre-Engineering

- Assess the needs of offering a Basic Circuits course for Engineering students.
- Assess the feasibility of offering a CAD course for Engineering students.

Annual review 2018

<table>
<thead>
<tr>
<th>Program-Level Outcomes Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-Engineering</strong></td>
</tr>
<tr>
<td><strong>Objective 1</strong>: Use and apply physical data to solve problems</td>
</tr>
<tr>
<td>ASTR 2513</td>
</tr>
<tr>
<td>MATH 2145</td>
</tr>
<tr>
<td>MATH 2155</td>
</tr>
<tr>
<td>X</td>
</tr>
<tr>
<td>X</td>
</tr>
<tr>
<td>X</td>
</tr>
<tr>
<td>X</td>
</tr>
<tr>
<td>X</td>
</tr>
</tbody>
</table>

**Objective 2**: Use logical reasoning to solve problems

| ASTR 2513                      |
| MATH 2145                      |
| MATH 2155                      |
| X                              |
| X                              |
| X                              |
| X                              |

**Objective 3**: Explain evolutionary theory and its supporting principles

| ASTR 1523                      |
| X                              |
| X                              |
| X                              |
| X                              |

**Objective 4**: Solve problems related to thermodynamics

| CHEM 1414                      |
| X                              |
| X                              |
| X                              |
| X                              |

**Objective 5**: Communicate scientific ideas through technical writing

| CHEM 1414                      |
| X                              |
| X                              |
| X                              |
| X                              |

| CHEM 1414                      |
| X                              |
| X                              |
| X                              |
| X                              |

**Objective 6**: Solve problems related to thermodynamics

| CHEM 1414                      |
| X                              |
| X                              |
| X                              |
| X                              |

**Objective 7**: Communicate scientific ideas through technical writing

| CHEM 1414                      |
| X                              |
| X                              |
| X                              |
| X                              |

| CHEM 1414                      |
| X                              |
| X                              |
| X                              |
| X                              |
| Objective 1: Sketch or identify and interpret graphs | MATH 1513 | MATH 1613 | MATH 2145 | MATH 2155 | X | X | X | X | X |
| Objective 2: Manipulate, simplify and/or solve expressions or equations. | MATH 1513 | MATH 1613 | MATH 2145 | MATH 2155 | MATH 2155 | MATH 2613 | X | X | X | X | X |
| Objective 3: Solve and interpret real world application problems. | MATH 1613 | MATH 2155 | X | X | X | X | X |

Associate in Science - Mathematics and Physical Science – Pre-Engineering

| Objective 1: Use and apply physical data to solve problems | PHYS 2014 | PHYS 2114 | MATH 2145 | MATH 2155 | X | X | X | X | X |
| Objective 2: Use logical reasoning to solve problems | PHYS 2014 | PHYS 2114 | MATH 2145 | MATH 2155 | X | X | X | X | X |
| Objective 3: Communicate scientific ideas through technical writing | PHYS 2014 | PHYS 2114 | X | X | X | X | X |
| Objective 4: Recognize connections between physical concepts and engineering applications | PHYS 2014 | PHYS 2114 | X | X | X | X | X |