Example of Adding GT Pathways Content Criteria and Competencies and Required Statement into a Syllabus

- **The text in black below is the text from the original syllabus.**
- **The text in red below is an example of how to map the GT Pathways content criteria and competencies by inserting them into the existing Course Outcomes on the syllabus. (Ian's note: I am not a physicist and have no idea if I mapped the GT Pathways content criteria and competencies to the appropriate community college Course Outcomes. This is just an example and physics faculty should have the final say here.)**

Syllabus - PHY 212: Physics: Calculus-based II, with Lab

Course Description:
Covers the physics of electricity and magnetism and requires application of classical physics to both mathematical and conceptual problems. DC circuits involving resistors, capacitors and batteries will be covered. This course may also include topics relating to traveling and standing waves, wave optics, geometric optics, and AC circuits.

Guaranteed Transfer (GT) Pathways Course:
The Colorado Commission on Higher Education has approved PHY 212: Physics: Calculus-based II, with Lab for inclusion in the Guaranteed Transfer (GT) Pathways program in the GT-SC1 category. For transferring students, successful completion with a minimum C– grade guarantees transfer and application of credit in this GT Pathways category. For more information on the GT Pathways program, go to http://highered.colorado.gov/academics/transfers/gtpathways/curriculum.html.

Course Outcomes and GT Pathways Content Criteria and Competencies:

1. Produce both numerical and symbolic solutions to problems using the techniques of calculus and the concepts of physics.
    - Examine quantitative approaches to study natural phenomena. (GT-SC1&2 Content Criteria).
    - Select or develop elements of the methodology or theoretical framework to solve problems in a given discipline (GT Competency: Inquiry and Analysis, 4a).
    - Explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words) (GT Competency: Quantitative Literacy, 1a).
2. Apply physics concepts and equations to real world problems and design challenges.
    - Obtain and interpret data, and communicate the results of inquiry (GT-SC1&2 Content Criteria).
3. Design scientific experiments, safely collect and analyze data and draw conclusions.
    - Develop foundational knowledge in specific field(s) of science (GT-SC1&2 Content Criteria).
    - Develop an understanding of the nature and process of science. (GT-SC1&2 Content Criteria).
    - Demonstrate the ability to use scientific methodologies (GT-SC1&2 Content Criteria).
    - Perform hands-on activities with demonstration and simulation components playing a secondary role. (GT-SC1&2 Content Criteria).
    - Engage in inquiry-based activities (GT-SC1&2 Content Criteria).
    - Demonstrate the ability to use the scientific method (GT-SC1&2 Content Criteria).
    - Demonstrate proper technique and safe practices (GT-SC1&2 Content Criteria).
    - Examine evidence to identify patterns, differences, similarities, limitations, and/or implications related to the focus (GT Competency: Inquiry and Analysis, 5a).
    - Utilize multiple representations to interpret the data (GT Competency: Inquiry and Analysis, 5b)
    - Convert information into and between various mathematical forms (e.g., equations, graphs, diagrams, tables, words) (GT Competency: Quantitative Literacy, 2a).
4. Communicate the ideas of classical physics both in everyday language and in the language of mathematics.

- State a conclusion based on findings (GT Competency: Inquiry and Analysis, 6a)

5. Explain and apply the concepts and equations of electrostatics, including Coulomb's Law, Gauss' Law, the electrical properties of matter and basic concepts relating to charge and charge transfer.
6. Explain and calculate the electric field and potential for discrete and continuous charge distributions.
7. Analyze parallel and series circuits involving resistors, capacitors, batteries and other DC circuit components.
8. Explain and apply the concepts and equations of magnetism, including Faraday's Law, the Ampere-Maxwell Law, the magnetic properties of matter and basic concepts relating to currents and induction.
9. Discuss the Lorentz Force Law and the effects of charges and currents on moving or stationary particles.
10. Explain the wave nature of light as indicated by Maxwell's equations.

Discretionary Course Outcomes:

11. Analyze plane and spherical waves in one, two and three dimensions and describe their behavior conceptually and mathematically. (Note: This outcome should be covered in either PHY 211 or PHY 212.)
12. Describe, both conceptually and mathematically, the superposition of two or more waves and apply these ideas to the phenomena of interference and diffraction.
13. Explain how standing waves are formed and relate the concepts and mathematics of standing waves to various situations, including waves on a string and waves in open and closed tubes.
14. Analyze the use of mirrors and thin lenses to focus or disperse light and apply to real uses of these tools.
15. Analyze, conceptually and by the use of phasors and equations circuits including combinations of inductors, resistors and capacitors.

Topical Outline

I. Waves (Discretionary)
   a. Nature of waves and the travelling wave equation.
   b. Superposition of waves
   c. Standing waves

II. Optics (Discretionary)
   a. Interference and diffraction
   b. Geometric optics

III. Electrostatics
   a. Electric charge
   b. Coulomb's Law
   c. Insulators and conductors
   d. Charge and field in/outside a conductor in electrostatic equilibrium
   e. The electric field of discrete and continuous charge distributions
   f. Electric flux
   g. Gauss' Law
   h. The electric potential of discrete and continuous charge distributions
   i. The Lorentz Force Law for electricity

IV. Circuits
   a. Resistance
   b. Capacitance
   c. Resistors and capacitors in parallel and series
   d. Resistor circuits

e. Current and voltage
f. Ohm's Law
g. RC circuits

V. Magnetism
a. Magnetic fields of moving charges and currents
b. The Biot-Savart Law
c. Faraday's Law
d. Induction
e. The Ampere-Maxwell Law
f. Displacement Current
g. The Lorentz Force Law for magnetism

VI. Maxwell's Equations
a. Maxwell's Equations in their integral form
b. The meaning of Maxwell's Equations, individually and as a group
c. Maxwell's Equations and electromagnetic waves
d. The electric and magnetic fields under a Galilean transformation

VII. Alternating Current Circuits (Discretionary)
a. Phasor diagrams
b. LC circuits
c. LRC circuits
d. Driven LRC circuits and resonance