1. **Course Title and Number of Credits:** CISE 417 Methods of Teaching Secondary Science (3 undergraduate credits).

2. **Course Description:** The emerging professional will organize learning experiences that include inquiry processes and knowledge construction fundamental to learning science. Developing concepts through concrete experience, an appreciation for relationships among science, technology, and society, and issues of equity and multiculturalism are stressed. Students are required to demonstrate competence in planning and applying learning cycles, authentic assessment, thematic integration, the use of technology to teach and access resources, and the maintenance of a safe, effective classroom.

Focus is on the middle and high school years with attention to formal and informal science education throughout life. Curriculum coherence across the grades will be emphasized with references to elementary science experiences on which the middle school curriculum builds. Emerging professionals will be prepared to enter a community of collaborators (science teachers, scientists, university science educators, parents, and community members).

3. **Pre-requisites:** CISE 335, CISE 340

4. **Course Objectives:** This course will develop students' conceptual understanding and knowledge that are needed to perform the following teaching tasks:

   a. Provide all of their students with a holistic and interdisciplinary understanding of science and its relationship to personal life and community through collaborative planning with N-12 colleagues, scientists, educational researchers and community members.

   b. Engage students in activities that reflect the nature of science in contemporary society; guide inquiries that use science and mathematics processes and problem-solving skills; and provide laboratory and field based learning experiences that foster the development of student research skills.

   c. Design and manage a learning environment that is physically and psychologically safe and nurturing for learners; consistent with active science learning; celebrates multiculturalism and pluralism; and reflects ethical and appropriate care for all living organisms and the environment.
d. Relate science to contemporary events, research results, and the daily lives of young people; orchestrate learning experiences that require students to develop skills of decision-making and value analysis in exploring relationships among science, technology, and society; and promote science and technology-related careers.

e. Plan and apply a coherent, focused curriculum that is consistent with state and national science education standards, appropriate for addressing the needs, abilities and interests of learners, uses a variety of strategies for instruction and assessment, effective curriculum materials and equipment in an active environment

f. Plan educational experiences that take advantage of educational technology, including the Internet, laser disk, and video.

g. Foreground authentic assessment as a crucial feature of instruction, including the assessment of prior knowledge, students' conceptualization, and the application of current research findings on early childhood and early adolescent learning.

h. Engage in ongoing self-assessment with respect to teaching and learning science by using processes of inquiry and reflection; know and participate in the professional organizations and activities, behave ethically and in the best interest of learners, and work willingly with peers, supervisors, and others in a professional manner.
5. Student Learning Outcomes*

After taking this course students will be able to:

1. Evaluate a science curriculum or science program using as evaluation criteria the recommendations that are reflected in the national and state standards for curriculum, teaching, and assessment

2. Plan, teach, and reflect on an inquiry-based science lesson with the following features:
   a. Is aligned with NJ Core Curriculum Science Standards;
   b. Engages diverse learners in independent and cooperative processes that make use of science process skills, problem-solving, and critical thinking in a supportive environment.
   c. Provides diverse learners with an understanding of science concepts and the relevance of science in their daily lives.
   d. Provides learners with an awareness of relevant historical and multi-cultural contributions to science.
   e. Provides learners with an awareness of a variety of science related careers
   f. Employs alternative assessments.
   g. Adheres to standards of safety and ethical care of the environment.

3. Develop an instructional unit or facilitate the completion of an extended science project in the field with the following features:
   a. Is correlated to NJ Core Curriculum Science Standards
   b. Integrates science disciplines, mathematics, oral / written communications, technology, and other subjects.
   c. Promotes a conceptual understanding of science through science inquiry processes, an understanding of relationships between science, technology and society through critical thinking and problem-solving, and an awareness of science related careers.
   d. Includes appropriate assessment(s) of learning outcomes.
   e. Identifies helpful science education resources including appropriate technology and science education partners at the local, state, and national level.

4. Design a physical / social environment for teaching and learning science. Include furniture / equipment for a modern facility for teaching and learning science. Describe activities that would be carried on in the facility and ways in which the members of the learning community work together.

5. Reflect on learning, engage in self assessment, and demonstrate positive dispositions related to the professional development activities including the following:
   a. Participation in collaborative inquiry and project work that construct science knowledge and knowledge about teaching and learning science.
   b. Participation in individual and group activities for the purpose of creating and evaluating science curriculum.
   c. Observing and analyzing teaching in the methods class and in the field.
d. Review of science education research, standards, and critical issues and problems in science education.

### Student Learning Outcomes - Standards Correlation

<table>
<thead>
<tr>
<th>Student Learning Outcome</th>
<th>NCATE/NSTA Standard(s)</th>
<th>NJ Teaching Standard(s)</th>
<th>WPU Competencies</th>
<th>NJ CCCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Evaluate, through collaboration, a science curriculum or science program.</td>
<td>1, 2, 3, 4, 6, 8</td>
<td>1, 2, 3, 5</td>
<td>18</td>
<td>5.1-5.10</td>
</tr>
<tr>
<td>2. Plan, teach, and reflect on inquiry-based science lessons.</td>
<td>1, 2, 3, 5, 6, 8</td>
<td>1, 2, 3, 4, 5, 8</td>
<td>12, 13, 16, 17</td>
<td>5.1-5.10</td>
</tr>
<tr>
<td>3. Develop an instructional unit or facilitate the completion of an extended science project.</td>
<td>1, 3, 4, 6, 7, 8</td>
<td>1, 2, 3, 4, 5, 8, 9</td>
<td>14, 13, 15</td>
<td>5.1-5.10</td>
</tr>
<tr>
<td>4. Design a learning environment for teaching and learning science at the secondary level.</td>
<td>9</td>
<td>2, 6</td>
<td>16, 20</td>
<td>5.1-5.10</td>
</tr>
<tr>
<td>5. Reflection, self assessment, and demonstration of positive dispositions.</td>
<td>1, 2</td>
<td>10</td>
<td>9, 10</td>
<td>5.1-5.10</td>
</tr>
</tbody>
</table>

* Correlations are based on criteria specified on page 3 in section on student learning outcomes.*

### 6. Course Content

1. The Nature of Science as a Model for School Science

   (a) Characteristics distinguishing science from other ways of knowing
   (b) Characteristics distinguishing basic science, applied science, and technology
   (c) Inquiry processes and conventions of science as a professional activity
   (d) Standards defining acceptable evidence and scientific explanation
   (e) Interdependence of Science, Technology, and Society
   (f) Science as a Global and Multicultural Activity
   (g) Mathematics as a tool of the Scientist

2. Historical Perspectives of Science Education in America

   (a) National development
   (b) Industrial progress
   (c) Golden Age
   (d) Contemporary initiatives and Scientific Literacy for all

3. Curriculum Recommendations

   (a) Integration of the Sciences (intradisciplinary and Interdisciplinary)
   (b) Incorporating Technology
   (c) Instructional Models
   (d) Cooperative Learning Strategies
   (e) Variation in of Teaching Strategies to Meet the Needs of Learners
(f) Accommodation of Diverse Learning Styles
(g) Broadened Role of Assessment
(h) Inquiry-based
(i) Less is more
(j) Model Middle School Curriculums
(k) Model High School Curriculums
(l) Procedures for evaluating and designing curriculum

4. Instructional Strategies
   (a) Inquiry and Conceptual Change - Learning Cycles
   (b) Questioning - (types, procedures, and techniques
   (c) Investigation and Problem-Solving
   (d) Demonstration and Laboratory with Considerations for Safety
   (e) Use of Textbooks

5. Assessment
   (a) Traditional models and their purposes
   (b) New models, their purposes, and conditions for best results
   (e) Observations - (cognitive and affective)
   (d) Concept mapping
   (e) Creative assessment
   (f) Journals and oral interviews
   (g) Projects
   (h) Portfolios
   (i) Practical assessments
   (j) Problem tests
   (k) Diagrams and Pictorial
   (l) Self evaluation

6. Understanding Learners and Managing the Learning Environment
   (a) Psychological basis for effective science teaching
   (b) Individual Differences
   (c) Cultural and Gender Differences
   (d) Physical Facilities

7. Designing and Implementing Lessons
   (a) 4 or 5 E's
   (b) Madeline Hunter
   (c) 4MAT;
   (d) Madeline Hunter

8. Uses of Educational Technology
   (a) Computer Assisted Instruction
   (b) Computer-based Labs;
   (c) Multimedia Presentations
   (d) Interactive Video;
   (d) Internet
9. Science beyond the Classroom
   (a) Problem based learning approaches
   (b) Research Projects
   (c) Science Fairs,
   (d) Apprenticeships
   (e) Family Science
   (e) Home Projects

6. **Teaching Methods**
   1. Hands-on science investigations
   2. Cooperative group projects
   3. Clinical experiences in parallel practicum course
   4. Demonstrations
   5. Analysis and discussion of readings and teaching episodes
   7. Student publication of science education related activities.

8. **Evaluation:**
   (1) Quality of curriculum evaluation (rubric)
   (2) Quality of lesson plan (rubric)
   (3) Quality of instructional unit (rubric)
   (4) Quality of design/rationale - of teaching-learning environment
   (5) Quality of reflective writing/ self-assessment (rubric)
   (6) Class participation / attendance

9. **Suggested Textbook:**


10. **Preparer's Name and Date:** Dr. Sondra Akins, Fall (2003)

11. **Department Approval:** Fall, 2003
12. Reviser's Name and Date: Dr. Sondra Akins, Fall, 2004
13. Department Revision Approval Date:

14. Bibliography


New Jersey Science Core Curriculum Content Standards (2002). NJ Department of Education.


**Periodicals**


*The Biology Teacher*. American Association of Biology Teachers.

*The Journal of Chemical Education*. American Chemical Society

*The Physics Teacher*. American Association of Physics Teachers.

**Web Sites**

NSTA web page. [www.NSTA.org](http://www.NSTA.org)
New Jersey Department of Education: [www.state.nj.us/njded/science/index.html](http://www.state.nj.us/njded/science/index.html)
[www.4kids.org/coolspots](http://www.4kids.org/coolspots)
[www.ecnet/users/utkrebs/webpage.htm](http://www.ecnet/users/utkrebs/webpage.htm)
[www.pbs.org](http://www.pbs.org)
[www.whyfiles.news.wisc.edu](http://www.whyfiles.news.wisc.edu)
[www.blueskies.sprl.umich.edu](http://www.blueskies.sprl.umich.edu)
[www.falcon.cc.ukans.edu/~globe2/blash.html](http://www.falcon.cc.ukans.edu/~globe2/blash.html)
ISTA web page. [http://www.nsta.org](http://www.nsta.org)
Science Friday On-Line. [http://www.sciencefriday.com](http://www.sciencefriday.com)

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