1. **Catalog Description**  
   SCI/PHY 5090 Special Topics in Physics for Natural Science Teachers  
   Intensive investigation of relevant topics of student/faculty interest. Prerequisite: Enrollment in the MS in Natural Sciences program and consent of the instructor.

2. **Course Objectives**  
   To provide students with an in-depth study of topics of special interest (i.e. elementary particles, cosmology, superconductors, semiconductors) to the extent that they are not ordinarily covered in traditional courses.

3. **Sample Course Outline** the outline below is intended as being a representative sample of a typical topics course. Topics will vary depending upon demand and the instructor.

   I. **Introduction**  
      i. Difficulties in Classical Physics  
      ii. Determinism and causality issues

   II. **Early Quantum Theory**  
      i. Bohr Model  
      ii. Spectroscopy  
      EXAM I

   III. **Relativity**  
      i. Einstein and Space-time  
      ii. Energy and momentum

   IV. **Dirac and Antiparticles**  
      i. Electrons and Positrons  
      ii. The muon and pion  
      EXAM II

   V. **Higher Energy**  
      i. Strange particles and the Lambda  
      ii. What is an elementary particle

   VI. **Weak Hypercharge**  
      i. Isotopic spin  
      ii. Weak interactions and beta decay

   VII. **Baryons and Nucleons**  
      i. Nuclear symmetry  
      ii. Strong interactions and Gell-Mann  
      EXAM III
VIII. Quarks
   i. The eightfold way
   ii. Strangeness and charm
   iii. Top and bottom as quarks

IX. Electroweak Unification
   i. The W particle and mass
   ii. The neutral Z particle

X. Grand Unified Theories
   i. The X boson
   ii. Decay of the proton
   iii. Matter-Antimatter symmetry

XI. Supersymmetric String Theory
   i. Gravity and the graviton
   ii. The Planck scale

EXAM IV

**Evaluation:** Students are evaluated based upon homework problems, quizzes, exams, a comprehensive final exam and classroom presentations. The precise weighting and nature of the evaluation tools varies slightly from instructor to instructor.

4. Implementation
   
   b. Faculty members assigned: Qualified Physics faculty for the relevant topic.
   c. Additional resources: No additional costs are incurred for this course.
   d. Textbook: The textbook will be selected based on the topic chosen (i.e. Hughes, Introduction to Elementary Particle Physics, Cambridge, 1998)

5. Rationale
   
   e. Purpose and Need:
      To provide practicing professional educators with knowledge and experience relating to new and emerging concepts and theories in Physics.

   f. Justification of Course Level and Prerequisites:
      All participants of this course will hold a baccalaureate degree. Many will currently be teaching physics and are seeking additional information and insights about specific topics in physics not treated in other classes.

   g. Similarity to Existing courses:
      No similar courses exist on campus for science teachers in physics.

   h. Requirement or Elective:
      This course is intended to be an elective in the M.S in Natural Sciences program. Special requirements for this course will depend upon the topic and the instructor, and may include a laboratory evaluation component.
6. Date Approved by Physics Department: 10/25/00

7. Date Approved by COSCC: 11/09/00

8. Date Approved by CGS: 2-6-01

9. Contact Persons: Keith Andrew, campus phone 217-581-3220
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