PROPOSAL TO ESTABLISH A NEW UNDERGRADUATE CONCENTRATION

Requesting that this new concentration take effect in the fall of 2013.

Proposal Contact Information:
Robert Culbertson
Associate Professor
Department of Physics
Robert.Culbertson@asu.edu
480-965-0945

DEFINITION

These are the minimum requirements for approval. Individual undergraduate concentrations may have additional requirements.

A concentration is a formalized selection of courses within a major.

An undergraduate concentration:

- Requires a minimum of 15 semester hours of which at least 9 semester hours must be upper division. Specialized concentrations (e.g. BIS Concentrations) may have additional or different requirements.

- Is offered by a single unit and is intended exclusively for students pursuing that particular major. If a concentration consists of courses from more than one college the approval of each college Dean is required.

PROPOSAL PROCEDURES CHECKLIST

Before academic units can advertise undergraduate concentrations or include them in their offerings as described in the university catalogs, they must be recommended for approval by the Curriculum and Academic Programs Committee and approved by the Executive Vice President and Provost.

A complete proposal should include:

☒ **1. A supporting letter from the chair of the academic unit verifying that:**

- The proposed concentration has been reviewed and has received faculty approval through appropriate governance procedures in the unit.
- The unit has the resources to support the concentration as presented in the proposal, without impacting core course resources.

☒ **2. A supporting letter from the office of the supervising dean verifying that the concentration has been reviewed and has received approval through appropriate governance procedures in the college.**

☒ **3. A supporting letter from each college/school dean from which individual courses, or the entire concentration, are taken.**

Memo from Department of Physics attached
Memo from Mary Lou Fulton Teachers College attached

☒ **4. A statement concerning demand for the program (student/community/market).**

The goal of this new concentration is to provide an efficient and attractive path to a career in high school physics teaching in order to increase the quality and quantity of new physics teachers to address the critical local, state, and national needs.

The number of high school students taking physics has more than doubled from 1987 to 2009 (American Institute of Physics). Two-thirds of new physics teachers do not have a physics degree.

Presently, the undergraduate path to physics teaching at ASU is the BAE degree, administered through Mary Lou Fulton Teachers College. This degree includes a rigorous amount of physics and is only a handful of courses matching the BS Physics degree course requirements. Although the Arizona Department of Education requires a minimum of 30 hours of education courses, the BAE nearly doubles that. Evidently this is a formidable barrier to students, as only three BAE (physics) degrees have been awarded since 2008. Furthermore, while the physics preparation is rigorous, it falls a little short of that needed for admission to graduate school.

Nationwide, the number of physics degrees awarded annually has been nearly constant since 1970, but the number of physics degrees awarded by ASU has doubled in the past five years and continues to increase.

☒ **5. List of learning outcomes for the program**

a. Students will acquire a working understanding of the conservation laws of physics, energy, momentum, and angular momentum.
b. Students will develop a deep understanding of the thermodynamic and statistical forces that govern molecular motion in cells.
c. Students will become proficient in the application of the scientific method for exploring hypotheses.
d. Students will practice creating and managing inclusion techniques within secondary education classroom.
e. Students will have experience in a K-12 classroom to gain a realistic understanding of the nature of science teaching.

☒ **6 A description of the requirements for this concentration. Be specific in listing required courses and specify the total minimum number of hours required for the concentration.**

- **Are any new courses required? If so, provide course syllabi and Proposal for Curriculum Action forms.**

The BS degree in Physics with a Concentration in Secondary Education requires the following courses:

BLE 220 (3) Foundations of Structured English Immersion
BLE 407 (3) SEI for Secondary Students

EDP 313 (3) Childhood and Adolescence
MAT 270 (4) Calculus with Analytic Geometry I
MAT 271 (4) Calculus with Analytic Geometry II
MAT 272 (4) Calculus with Analytic Geometry III
PHY 118 (1) Explorations in Science Teaching
PHY 150 (4) Physics I
PHY 151 (4) Physics II
PHY 201 (3) Mathematical Methods in Physics I
PHY 252 (4) Physics III
PHY 302 (3) Mathematical Methods in Physics II
PHY 310 (3) Classical Particles, Fields, and Matter I
PHY 311 (3) Classical Particles, Fields, and Matter II
PHY 314 (3) Quantum Physics I
PHY 315 (3) Quantum Physics II
PHY 333 (3) Electronic Circuits and Measurements
PHY 334 (3) Advanced Laboratory I
PHY 412 (3) Classical Particles, Fields, and Matter III
PHY 441 (3) Statistical and Thermal Physics
PHY 480 (3) Methods of Teaching Physics
SED 322 (3) Classroom Leadership in Secondary Schools
SED 397 (1) Field Experience II
SED 478 (8) Student Teaching in the Secondary School
SED 496 (1) Field Experience III
SPE 222 (3) Orientation to Education of Exceptional Children
SPE 417 (3) Inclusion Practices at the Secondary Level
TEL 311 (3) Introduction and Management in the Inclusive Classroom

Total minimum number of hours required for the concentration: 89

The following new course is required. Syllabus and new course proposal has been submitted through Curriculum ChangeMaker.

PHY 118 Explorations in Science Teaching

☒ **7. A list of the primary faculty participants.**

Dr. Robert Culbertson, Associate Professor, PhD, experimental solid state physics & science education who will teach PHY 150 & PHY 151.

Kelli Gamez Warble will teach PHY 118 and PHY 480.

☒ **8. A minimum residency requirement: How many hours of the concentration must be ASU credit?**

Minimum 30 with a minimum of 12 upper-division hours in the major.

☒ **9. Please prepare and attach a Major Map.**

Attached

☒ **10. A completed Appendix document. This information is to be used during the implementation phase to ensure this program appears correctly and completely on Degree Search.**

☐ **11. Attach other information that will be useful to the review committees and the Office of the Provost.**

APPENDIX

OPERATIONAL INFORMATION FOR UNDERGRADUATE CONCENTRATIONS

(This information is used to populate the Degree Search/catalog website.
Please consider the student audience in creating your text.)

1. **Proposed Concentration Name:** BS in Physics with a concentration in Secondary Education

2. **Program Description** (150 words maximum)
Physics is the cornerstone of STEM (science, technology, engineering, and mathematics) disciplines. At ASU and nationally, the production of new physics teachers is far below the need. The shortage of highly qualified physics teachers in every state is an ongoing problem. This degree concentration is designed to produce more and better qualified physics teachers.
The BS in physics with a concentration in secondary education provides rigorous training in physics and in education. Students who graduate from this program will be recommended by the Mary Lou Fulton Teachers College for certification by the State of Arizona.

3. **Contact and Support Information**

Building Name, code and room number: *(Search ASU map)*	PSF 470
Program office telephone number: (*i.e. 480/965-2100*)	480/965-7195
Program Email Address:	Physics.info@asu.edu
Program Website Address:	http://physics.asu.edu

4. **Delivery/Campus Information Delivery:** On-campus only (ground courses and/or iCourses)
Note: Once students elect a campus or On-line option, students will not be able to move back and forth between the on-campus and the ASU Online options. Approval from the Office of the Provost and Philip Regier (Executive Vice Provost and Dean) is required to offer programs through ASU Online.

5. **Campus/Locations:** *indicate **all** locations where this program will be offered.*

☐ Downtown Phoenix ☐ Polytechnic ☒ Tempe ☐ West Other:

6. **Additional Program Description Information**

A. Additional program fee required for this program?	Yes
B. Does this program have a second language requirement?	No

7. **Career Opportunities & Concentrations**
Provide a brief description of career opportunities available for this degree program. If program will have concentrations, provide a brief description for each concentration. (150 words maximum)

Students graduating with a BS in Physics with a concentration in secondary education will have tremendous opportunities for employment. With over one million students in a state ranked seventh in the nation in population growth, the need for certified teachers in Arizona is self-evident. Physics is the core STEM (science, technology, engineering, and mathematics) subject, yet less than half of in-service physics teachers have degrees in physics. The need for qualified physics teachers is among the highest of all subject areas. Over the last 15 years ASU grads have had their pick of teaching jobs around the valley and in the state. After student teaching in school districts in the greater Phoenix area or on one of the 22 Native American nations, students are often hired to teach in the same school where they completed their internship. As the predicted rate of population growth climbs and the number of teachers retiring increases, new teachers will continue to be in demand.

8. Additional Admission Requirements

If applicable list any admission requirements (freshman and/or transfer) that are higher than and/or in addition to the university minimum undergraduate admission requirements.)
none

9. Keywords

List all keywords used to search for this program. Keywords should be specific to the proposed program.
Physics, physics education, secondary physics, physics teaching, high school physics, physical science

10. Advising Committee Code

List the existing advising committee code to be associated with this degree. UGASPH

Note: If a new advising committee needs to be created, please complete the following form:
Proposal to create an undergraduate advising committee

11. First Required Math Course

List the first math course required in the major map. MAT 270

12. Western Undergraduate Exchange (WUE) Eligible:

Has a request been submitted to the Provost by the Dean to consider this degree program as eligible for WUE?No

Note: No action will be taken during the implementation process with regards to WUE until approval is received from the Provost.

13. Area(s) of Interest

A. Select **one (1)** primary Area of Interest from the list below that applies to this program.

- ☐ **Architecture, Construction & Design**
- ☐ **Artistic Expression & Performance**
- ☐ **Biological Sciences, Health & Wellness**
- ☐ **Business, Management & Economics**
- ☐ **Communication & Media**
- ☐ **Computing & Mathematics**
- ☒ **Education & Teaching**
- ☐ **Engineering & Technology**
- ☐ **Environmental Issues & Physical Science**
- ☐ **Interdisciplinary Studies**
- ☐ **Languages & Cultures**
- ☐ **Law & Justice**
- ☐ **Social Science, Policies & Issues**

B. Select **any** additional Areas of Interest that apply to this program from the list below.

- ☐ **Architecture, Construction & Design**
- ☐ **Artistic Expression & Performance**
- ☐ **Biological Sciences, Health & Wellness**
- ☐ **Business, Management & Economics**
- ☐ **Communication & Media**
- ☐ **Computing & Mathematics**
- ☐ **Education & Teaching**
- ☒ **Engineering & Technology**
- ☒ **Environmental Issues & Physical Science**
- ☒ **Interdisciplinary Studies**
- ☐ **Languages & Cultures**
- ☐ **Law & Justice**
- ☐ **Social Science, Policies & Issues**

ARIZONA STATE UNIVERSITY

PROPOSAL TO ESTABLISH A NEW UNDERGRADUATE CONCENTRATION

The following fields are to be completed by the Office of the Executive Vice President and Provost of the University.
CIP Code: _____
Plan Code:

ARIZONA STATE UNIVERSITY

2013 - 2014 Major Map
B.S. in Physics with a concentration in secondary education, BS (Proposed)

Term 1 0 - 14 Credit Hours Critical course signified by ◆	Hours	Minimum Grade	Notes
◆ MAT 270: Calculus with Analytic Geometry I (MA)	4	C	• An SAT, ACT, Accuplacer, or TOEFL score determines placement into first-year composition courses • ASU Math Placement Exam score determines placement in Mathematics course • Minimum cumulative 2.50 GPA in all critical courses • Minimum grade of C required in all MAT and STP classes; grade of B or better strongly correlated with timely graduation • All freshmen must pass an academic success course and therefor must enroll in an Academic Success Cluster and/or a First-Year Seminar
Elective	1		
ENG 101 or ENG 102: First-Year Composition OR ENG 105: Advanced First-Year Composition OR ENG 107 or ENG 108: English for Foreign Students	3	C	
Humanities, Fine Arts and Design (HU) AND Historical Awareness (H)	3		
Social and Behavioral Sciences (SB) OR Humanities, Fine Arts and Design (HU)	3		
◆ Maintain 2.50 GPA in Critical Tracking Courses.			
◆ Minimum 2.50 GPA ASU Cumulative.			
Term hours subtotal:	14		

Term 2 15 - 29 Credit Hours Critical course signified by ◆	Hours	Minimum Grade	Notes
◆ MAT 271: Calculus with Analytic Geometry II (MA)	4	C	• Minimum ASU cumulative GPA of 2.5 required
◆ PHY 150: Physics I (SQ)	4	C	
◆ SPE 222: Orientation to Education of Exceptional Children (SB & C)	3	C	
PHY 118: Explorations in Science Teaching	1	C	
ENG 101 or ENG 102: First-Year Composition OR ENG 105: Advanced First-Year Composition OR ENG 107 or ENG 108: English for Foreign Students	3	C	
◆ Minimum 2.50 GPA ASU Cumulative.			
Term hours subtotal:	15		

Term 3 30 - 46 Credit Hours Critical course signified by ◆	Hours	Minimum Grade	Notes
◆ PHY 151: Physics II (SQ)	4	C	
◆ MAT 272: Calculus with Analytic Geometry III (MA)	4	C	
BLE 220: Foundations of Structured English Immersion	3	C	
CLAS Science and Society Elective	3	C	
Humanities, Fine Arts and Design (HU) AND Global Awareness (G)	3		
Complete Mathematics (MA) requirement.			
Milestone: Submit intent to progress form (online)			
◆ Complete First-Year Composition requirement.			
◆ Minimum 2.50 GPA ASU Cumulative.			
Term hours subtotal:	17		

Term 4 47 - 62 Credit Hours Critical course signified by ◆	Hours	Minimum Grade	Notes
◆ PHY 252: Physics III (SQ)	4	C	
PHY 201: Mathematical Methods in Physics I (CS)	3	C	
PHY 333: Electronic Circuits and Measurements	3	C	
EDP 313: Childhood and Adolescence (SB) or TEL 315: Child and Adolescent Development (L or SB)	3	C	
Literacy and Critical Inquiry (L)	3		
Milestone: Apply for DPS Fingerprint Clearance Card.			
◆ Minimum 2.50 GPA ASU Cumulative.			
Term hours subtotal:	16		

Term 5 63 - 77 Credit Hours	Hours	Minimum Grade	Notes
PHY 302: Mathematical Methods in Physics II	3	C	
PHY 310: Classical Particles, Fields, and Matter I	3	C	

PHY 314: Quantum Physics I	3	C
PHY 480: Methods of Teaching Physics	3	C
Upper Division CLAS Science and Society Elective	3	C
Milestone: Must attend an iTeachAZ Enrollment Workshop		
Milestone: DPS fingerprint clearance card on file with MLFTC advising office (to be uploaded with iTeachAZ application)		
Minimum 2.50 GPA ASU Cumulative.		
Term hours subtotal:	15	

Term 6 78 - 93 Credit Hours	**Hours**	**Minimum Grade**	**Notes**
PHY 311: Classical Particles, Fields, and Matter II	3	C	• Must possess valid DPS fingerprint card to participate in Field Experience
PHY 315: Quantum Physics II	3	C	
PHY 334: Advanced Laboratory I (L)	3	C	
SED 397: Field Experience I	1	Y	
BLE 407: SEI for Secondary Students	3	C	
TEL 311: Instruction and Management in the Inclusive Classroom	3	C	
Minimum 2.50 GPA ASU Cumulative.			
Term hours subtotal:	16		

Term 7 94 - 109 Credit Hours	**Hours**	**Minimum Grade**	**Notes**
PHY 412: Classical Particles, Fields, and Matter III	3	C	• Register for the AEPA exams for secondary mathematics and professional knowledge (NES).
PHY 441: Statistical and Thermal Physics	3	C	
SED 322: (Classroom Leadership in Secondary Schools)	3	C	
SED 496: Field Experience III	1	Y	
SPE 417: Inclusion Practices at the Secondary Level	3	C	
Humanities, Fine Arts and Design (HU) AND Historical Awareness (H)	3		
Minimum 2.50 GPA ASU Cumulative.			
Term hours subtotal:	16		

Term 8 110 - 120 Credit Hours	**Hours**	**Minimum Grade**	**Notes**
SED 478: Student Teaching in the Secondary School	8	Y	
Elective	3		
Minimum 2.50 GPA ASU Cumulative.			
Term hours subtotal:	11		

- o All students pursuing a B.S. or B.S.P. degree in the College of Liberal Arts and Sciences must complete two courses from the Science and Society list found at https://clas.asu.edu/advising-and-academic-services/science-and-society. At least one of the two courses must be upper division. Students must earn a C or better in the courses, and no more than one of the two can also be used to simultaneously fill a requirement of the major, minor or related area. Science and Society courses cannot also be used to fill the general studies HU, SB, SO or SG requirements.

Total Hours: 120
Upper Division Hours: 45 minimum
Major GPA: 2.00 minimum
Cumulative GPA: minimum
Total hrs at ASU: 30 minimum
Hrs Resident Credit for Academic Recognition: minimum
Total Community College Hrs: maximum

General University Requirements Legend

General Studies Core Requirements:
- Literacy and Critical Inquiry (L)
- Mathematical Studies (MA)
- Computer/Statistics/Quantitative Applications (CS)
- Humanities, Fine Arts and Design (HU)
- Social and Behavioral Sciences (SB)
- Natural Science - Quantitative (SQ)
- Natural Science - General (SG)

General Studies Awareness Requirements:
- Cultural Diversity in the U.S. (C)
- Global Awareness (G)
- Historical Awareness (H)

First-Year Composition

General Studies designations listed on the major map are current for the 2013 - 2014 academic year.

From:	Robert Page
Sent:	Wednesday, October 24, 2012 12:12 PM
To:	Curriculum Planning
Cc:	Jenny Smith
Subject:	FW: Proposal for a BS degree in Physics with a Concentration in Secondary Education
Attachments:	Checklist and Appendix Physics SED Concentration[1].docx; Major Map BS Physics Option 2 Concentration in Secondary Education v2.doc; BS Physics Option 2 Concentration in Secondary Education[1].docx; Letters of support BS Physics w SED Con.pdf
Importance:	High

I approve.

Rob

From: Jenny Smith <jenny.smith@asu.edu>
Date: Wednesday, October 24, 2012 9:45 AM
To: Microsoft Office User <Robert.Page@asu.edu>
Cc: Paul LePore <paul.lepore@asu.edu>, Patty <p.duncan@asu.edu>
Subject: Proposal for a BS degree in Physics with a Concentration in Secondary Education

Dean Page,

The CLAS Curriculum Committee and Senate have approved the attached proposal for a BS degree in Physics with a Concentration in Secondary Education Please forward the proposal with your approval to curriculumplanning@asu.edu.

Thank you,
Jenny

JENNY SMITH
Executive Administrative Support Specialist
College of Liberal Arts and Sciences
Arizona State University | P.O. Box 876605 | Tempe, Arizona 85287-6605
480.965.6506 | Fax: 480.965.2110 | e-mail: jenny.smith@asu.edu

ASU College of Liberal Arts & Sciences
ARIZONA STATE UNIVERSITY

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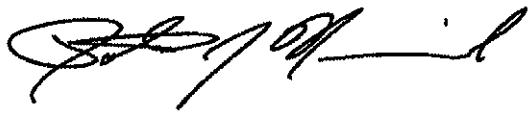
physics.asu.edu

MEMORANDUM

To: Professor Robert Page, Dean and Vice Provost
College of Liberal Arts and Sciences

From: Professor Robert J. Nemanich, Chair
Department of Physics



Date: October 5, 2012

Subject: Establishment of B.S. Physics with a Concentration in Secondary Education

This memo presents the support of the Department of Physics for the establishment of a B.S. Physics with a Concentration in Secondary Education as described in the submitted application.

The degree program addresses a core component of the Department's plans to enhance physics and science education in Arizona.

The proposed concentration has been reviewed by the Department's Undergraduate Program Committee, and it was unanimously recommended by that committee. The recommendation of the committee and all documents were submitted electronically to the academic faculty of the department, and the program was overwhelmingly recommended through an email vote.

This email verifies that the Department can provide the necessary resources to support the program without negatively impacting core course resources. In fact, the Department recognizes that this program would offer a potentially desirable option for current students.

The Department enthusiastically endorses this proposal to establish a new concentration: B.S. Physics with a Concentration in Secondary Education.

Mary Lou Fulton Teachers College
ARIZONA STATE UNIVERSITY

October 1, 2012

To: Curriculum and Academic Program Committee

From: Mari Koerner, Dean, Mary Lou Fulton Teachers College

Re: BS degree in physics with a concentration in secondary education

This memo confirms the support of Mary Lou Fulton Teachers College for the BS degree in physics with a concentration in secondary education. I have personally perused these materials and find them in keeping with the college expectations for a secondary education concentration. As direct support for this BS degree in physics, this proposal has been reviewed by an academic advisor to confirm its inclusion of course work and practicum experiences required for an institutional recommendation for secondary education. It has also received appropriate faculty approval.

As the above comments indicate, I recommend this proposal without reservation. It takes an important step toward offering multiple paths for teacher candidates to teach in secondary schools: (1) obtaining a concentration in secondary education while completing a major in a discipline or (2) obtaining a degree in secondary education with a specialization within a discipline.

Arizona State University
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PO Box 37100, Phoenix, AZ 85069-7100
(602) 543-6300 Fax: (602) 543-6350
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