

Missouri State University Curricular Proposal – New Interdisciplinary Program (Major, Minor, Certificate)

This special form is to be used for internal Missouri State approval of a new Interdisciplinary program involving two or more academic departments/schools including graduate programs, undergraduate majors (comprehensive or non-comprehensive), minors, graduate certificates, and undergraduate certificates

New graduate programs, new undergraduate majors, and certificate programs involving more than 18 credit hours, require approval by the CBHE as well as approval through the Missouri State curricular process. CBHE applications for such programs are processed through the Office of Institutional Research. All proposals for new programs requiring CBHE approval should progress through the Missouri State curricular process accompanied by a draft of the required CBHE documentation.

Attach on separate sheets (1) statement of rationale and objectives, (2) estimated costs for first five years, and (3) complete catalog description (including new courses and course changes pending approval). [Note: For new programs requiring CBHE approval, CBHE forms NP, PS, and PG will satisfy #1 and CBHE form FP will satisfy #2.]

Sponsoring Department (1) (responsible for administration and budget) Physics, Astronomy and Materials Science

Sponsoring Department (2) Mathematics

Sponsoring Department (3) (if applicable) Computer Science

Sponsoring Department (4) (if applicable) Chemistry

Proposed Program Title Computational Science

Check One: Major Comprehensive Major Minor Undergraduate Certificate Graduate Certificate Master's Degree

Degree Applicability (i.e., BA, BS, MA, MS, etc.) _____

General Education Courses Required n/a Total Hours _____

General Education Courses Recommended n/a Total Hours _____

Requirements (including Admission) and Limitations for Specific Program Student in good standing with proper pre-requisites

PHY 291 (3), CSC 125 (4), MTH/CSC 421 (3), MTH/CSC 422 (3), 5 hours of sci electives approved by advisor Total Hours 18

Prerequisites for Required Courses MTH 280, MTH 303

Recommended Electives _____ Total Hours _____

Limitations on Electives _____

DEPARTMENT: Route according to ART VI, SEC 3B (1-4) of Bylaws of the Faculty Senate. Attach New Program Resource Information form (FS-302a/06) and forward three typed, originally signed forms to one of the following (please mark all that apply.) If the program needs to go through more than one committee/council, forward one additional form for each additional council/committee marked.

- College Council (Send all new undergraduate programs through College Council as first step before forwarding either to PEC, CGEIP, or directly to Faculty Senate)
- Professional Education Committee (All proposals affecting BS and MS in Education and Educational Specialist degrees)
- Committee on General Education and Intercollegiate Programs (All general education and multi-college programs)
- Graduate Council (All graduate programs)

Signatures of department heads:

[Signature] Sponsoring Department (1) (responsible for administration and budget) Date 1-3-13

[Signature] Sponsoring Department (2) Date 1/8/14

[Signature] Sponsoring Department (3) (if applicable) Date 1/8/14

[Signature] Sponsoring Department (4) (if applicable) Date 1/7/14

Rationale: For many years, the physical sciences were broken up into experimental and theoretical branches, where the latter was pursued through the aid of primarily analytical and mathematical techniques. However, for the last few decades problems that were intractable to standard paper and pencil approaches were addressed through the utilization of the tools of computational science. As many know, the aftermath of the second world war saw the creation of a new "science" where computers were designed and software written to solve problems of scientific interest.

Even though the inclusion of computational elements has been common in most scientific fields, it is still somewhat rare to see a coherent set of courses required of students who most likely will go into industrial settings where they will be needed. On speaking with many of our industrial partners and to former students, it is clear that most students are still undertrained in the techniques used in computational science. Those techniques include the modeling of a physical process designed to create an algorithm, the construction of a pseudo-code framework which represents the computational flow, and the correct utilization of mathematical foundations on which the entire program rests.

We intend to create this certificate out of existing courses. In most cases, the enrollment of any given courses in the sequence might increase by small numbers, on the order of 5 students. The goal is to allow students already in the sciences to get a broad grounding in the area and to then receive formal credit for it, rather than have to explain their transcripts to their potential employers.

Projected Costs: Each of the courses, including all electives, are taught regularly and so the expected cost is considered negligible.

Courses:

PHY 291 Introduction to Computational Physics

Prerequisite: MTH 280.

Numerical and computer methods related to physics modeling and data analysis. Introduction of physics applications using symbolic, matrix, and spreadsheet software including programming. Programming applied directly to physical simulations. Recent advances in physics-related computing

CSC 125 Introduction to C++ Programming

Programming and problem-solving using C++. Language constructs for assignment, flow control, input/output and functions are studied and applied. Techniques of object-oriented programming are introduced.

MTH 421 Numerical Analysis I

Prerequisite: MTH 280.

Recommended Prerequisite: CSC 125 or CSC 130. Solution of systems of linear and nonlinear equations, interpolation, integration, approximation, matrix computations. Problem solution will include the use of software. Identical with CSC 421. Cannot receive credit for both MTH 421 and CSC 421.

MTH 422 Numerical Analysis II

Prerequisite: MTH 303 and MTH 421.

Solution of initial and boundary value problems in ordinary and partial differential equations, simulation, and optimization. Problem solution will include the use of software. Identical with CSC 422. Cannot receive credit for both MTH 422 and CSC 422.

Examples of electives

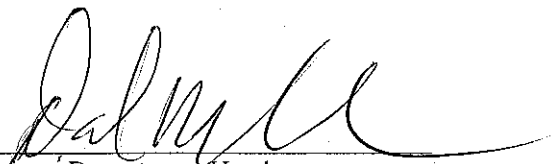
CHM 597 (topics) Chemical Bonding

Prerequisite: CHM 607.

Quantum mechanics; atomic and molecular structure; computational procedures. Independent study project required.

8. Referring to question 6, if additional faculty are not required, please provide a statement as to how faculty will be made available to teach proposed new courses, if any, or to manage increased enrollments in existing courses which are to be included in the proposed new program. See attached
9. If the responses to question 1 and any parts of question 6 other than additional faculty are "no," please provide a statement as to how the department/school (or center or college) will manage the enrollment figures provided in question 5. See attached

The signature of the individuals listed below ensures that the items above have been addressed and the resources needed will be made available when the program is implemented.



Department Head



College Dean

**Missouri State University
Curricular Proposal Program Change or Deletion**

Department Physics, Astronomy, and Materials Science Date January 4, 2104

Title of Program Affected Physics

Type of Program: Major Comprehensive Major Option Minor Certificate Certification
Academic Rules Other

Revised Catalog Description (cut and paste present description from online catalog, strikethrough all deletions, and insert and bold new information)

A. General Education Requirements - see General Education Program and Requirements section of catalog

Specific General Education Requirements: PHY 203(5), MTH 261(5), ENG 321(3)

B. Major Requirements

1. PHY 152(3), 204(5), 291(3), 333(3), 343(3), 353(3), 375(3), 385(2), 386(1), 391(3), 486(1)
2. Select one of the following option areas:
 - a. **Astronomy and Astrophysics:** AST 113(3), 114(4), or 115(4); and select two courses from: AST 311(3), 313(3), 315(3), 317(3)
 - b. **Engineering and Applied Physics:** ~~CSC 125(4);~~ PHY 220(4), 324(4), 351(3)
 - c. **Materials Physics:** MAT 540(3), 550(3), 580(3); PHY 575(3)
 - d. **Graduate Prep Physics:** MAT 580(3); PHY 351(3), 476(3), 575(3)
3. Related Requirements: MTH 280(5), 302(3), 303(3)

C. General Baccalaureate Degree Requirements - see General Baccalaureate Degree Requirements section of catalog

Complete New Catalog Description

A. General Education Requirements - see General Education Program and Requirements section of catalog

Specific General Education Requirements: PHY 203(5), MTH 261(5), ENG 321(3)

B. Major Requirements

1. PHY 152(3), 204(5), 291(3), 333(3), 343(3), 353(3), 375(3), 385(2), 386(1), 391(3), 486(1)
2. Select one of the following option areas:
 - a. **Astronomy and Astrophysics:** AST 113(3), 114(4), or 115(4); and select two courses from: AST 311(3), 313(3), 315(3), 317(3)
 - b. **Engineering and Applied Physics:** PHY 220(4), 324(4), 351(3)
 - c. **Materials Physics:** MAT 540(3), 550(3), 580(3); PHY 575(3)
 - d. **Graduate Prep Physics:** MAT 580(3); PHY 351(3), 476(3), 575(3)
3. Related Requirements: MTH 280(5), 302(3), 303(3)

C. General Baccalaureate Degree Requirements - see General Baccalaureate Degree Requirements section of catalog

Total Hours 63-66

What is changing? Check all boxes that apply.


- | | | |
|--|---|--------------------------------------|
| <input type="checkbox"/> Title change | <input type="checkbox"/> From option to program (major) | <input type="checkbox"/> Other _____ |
| <input checked="" type="checkbox"/> Course changes of under 18 hours | <input type="checkbox"/> From program (major) to option | |
| <input type="checkbox"/> Course changes of 18 hours or more | <input type="checkbox"/> Program or option deletion | |

Reason for Proposed Change

New course allowed in one option, better match between courses in another, and Alumni advice added a course to another.

DEPARTMENT: Route according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty Senate. Forward three typed, originally signed forms to one of the following (please check all that apply and send to first council/committee marked). If the program needs to go through more than one committee/council, forward one additional form for each additional council/ committee marked.

- | | |
|--|--|
| <input checked="" type="checkbox"/> College Council | (Send all undergraduate program changes through College Council as first step before forwarding either to PEC, CGEIP, or directly to Faculty Senate) |
| <input type="checkbox"/> Professional Education Committee | (Considers all program changes affecting BS and MS in Education and Educational Specialist degrees) |
| <input type="checkbox"/> Committee on General Education and Intercollegiate Programs | (Considers all general education and multi-college program changes) |
| <input type="checkbox"/> Graduate Council | (Considers all graduate-level program changes) |

Signature 
Department Head

Date 1-3-13

Missouri State University
Curricular Proposal Course Change or Deletion

Department Physics, Astronomy and Materials Science

Date January 3, 2013

Check one: This is a change to an existing COURSE
 an existing REGULAR (i.e. permanent) SECTION of a variable content course

Present Course Code and Number PHY 123

Course Title Introduction to Physics I

Revised Catalog Description (Copy/paste present description from online catalog, strikethrough all deletions, and insert/bold new information.)

Prerequisite: ~~MTH 287~~ or eligibility for enrollment in MTH 261; and ~~CIS/CSC 101 or CSC 111~~. General Education Course (Natural World).

An introduction to physical theories covering the content areas of mechanics, fluids, sound, and thermodynamics. A knowledge of the laws of Physics will help the student better understand the world and how these laws can be used to make informed decisions to improve society. A grade of "C" or better is required in this course to take PHY 124. Supplemental course fee.

Complete New Catalog Information

Prerequisite: ~~MTH 287~~ or eligibility for enrollment in MTH 261. General Education Course (Natural World).

An introduction to physical theories covering the content areas of mechanics, fluids, sound, and thermodynamics. A knowledge of the laws of Physics will help the student better understand the world and how these laws can be used to make informed decisions to improve society. A grade of "C" or better is required in this course to take PHY 124. Supplemental course fee.

What is changing? Check all boxes that apply.

- Course Deletion Course Code Course Number Title Prerequisite
 Credit Hours/Contact Hours Periodicity Description

Reason for Proposed Change or Deletion some majors are taking MTH 287, which has a different prereq stream than MTH 261, requiring constant overrides.

How Did You Determine the Need For This Change or Deletion? Requests from TCM and students

Check if this is a non-substantive change. Distribution for non-substantive changes of 100- through 500-level courses: two originally-signed copies to Faculty Senate; 600- through 900-level courses: three originally-signed copies to Graduate Council. Graduate Council will give two copies to Faculty Senate after approval.

Substantive Change: Department routes according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty. Forward three originally signed forms to one of the following (please check all that apply and send to first council/committee marked): If proposal needs to go through more than one council/committee, forward one additional form for each additional council/committee marked. See Senate Action 11-93/94 for definitions of substantive/non-substantive changes.

College Council

(All substantive course changes numbered 100-599 must go through College Council first. After approval, College Council will forward appropriate number of copies to the next committee/council or directly to the Faculty Senate if no further committee approval is needed. The last level of committee/council will forward two originally signed copies to the Faculty Senate.)

Professional Education Committee

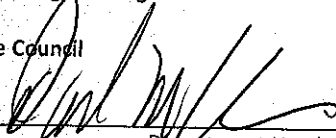
(Considers all substantive course changes for Professional Education courses and Teaching Methods courses.)

Committee on General Education and Intercollegiate Programs

(Considers all substantive course changes for General Education and Intercollegiate Program proposals.)

Graduate Council

(Considers all 600-900 level course changes.)

Signature 

Department Head

Date

1-3-13

(Routing on Reverse Side)

FS Program Change - 10/8/2013