## 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.]

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Sponsoring Department (1) (responsible	e for administration and budget) Physics, Astronomy and Materials Sci	ence
Sponsoring Department (2) Mathematic		
Sponsoring Department (3) (if applicable	e) <u>Computer Science</u>	
Sponsoring Department (4) (if applicable	c) Chemistry	
Proposed Program Title Computational S		
Check One:   Major   Comprehensive I	Major □ Minor x Undergraduate Certificate □ Graduate Certificate	
Degree Applicability (i.e., BA, BS, MA, MS	, etc.)	□ Master's Degree
General Education Courses Required n/a		/ Total Hours
General Education Courses Recommende	ed_n/a	
Requirements (including Admission) and I	Limitations for Specific Program_Student in good standing with prope	_Total Hours
PHY 291 (3) CSC 125 (4) MTH/CSC 421 (2	2) MTH/CCC 422 (2) 5 have 6 in the minimum standing with prope	
Prerequisites for Paguired Courses NATIVE	3), MTH/CSC 422 (3), 5 hours of sci electives approved by advisor	Total Hours <u>18</u>
Prerequisites for Required Courses MTH	280, MTH 303	
Recommended Electives		Total Hours
Limitations on Electives		
	C 3B (1-4) of Bylaws of the Faculty Senate. Attach New Program Resource In signed forms to one of the following (please mark all that apply.) If the programd one additional form for each additional council/committee marked. (Send all new undergraduate programs through College Council as first step be PEC, CGEIP, or directly to Faculty Senate)  (All proposals affecting BS and MS in Education and Educational Specialist degradation and education and multi-college programs)	gram needs to go fore forwarding either to
Graduate Council	(All graduate programs)	
Signatures of department heads:		
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Sponsoring Department (1) (responsible fo	r administration and hydrost	
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Sponsoring Department (2)	Date/ \\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	
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Sponsoring Department (3) (if applicable)	Date/8/14	· · · · · · · · · · · · · · · · · · ·
1105		
Sponsoring Department (4) (if applicable)	Date 1/7/19	
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**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.

## NEW PROGRAM RESOURCE INFORMATION

Pro	gram Title and Degree:	<u>Undergraduate Certifica</u>	te in Computational Science					
Dep	Department: Physics, Math, CSC, CHM							
and [No	(3) complete catalog descr	ription (including new cou uiring CBHE approval, CB	objectives, (2) estimated costs for first rses and course changes pending appr HE forms NP, PS, and PG will satisfy	oval).				
1.	Is another program being	deleted or altered?	Yes x No					
2.	If this program affects of been attached to the prop	her departments or college osal?	s, has a memo showing how it will af  X Yes No	fect them				
3.	What justification is bein certification or licensing	g provided to support this requirements, other.) Attac	proposal? (Current research, accredit	ation,				
4.	If your response to #3 refers to existing or potential student demand, please indicate the activities undertaken to estimate or verify the potential or existing demand for this new program.							
5.	What are the present/futu	re projected enrollments fo	or this program?					
	1 <sup>st</sup> year_5	3 <sup>rd</sup> year 10						
	In five years, how many	students must be:						
		tify this new minors contir		·				
6.	Which of the following wapply.) Individuals respo	ould be needed to implem nsible for specific areas or	ent the proposed program? (Check a	II that ed.				
	Additional library holding Additional technology or Additional or remodeled a Additional travel funds? Additional faculty? Additional support staff? Other additional expenses	other supplies? facilities?		No No No No No				
7.	Have the individuals respansional availability of these resou x (n/a) Yes	rces by the time the progra	ese resources been contacted to ensur am is implemented? annot ensure availability	e the				

- 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

FS Program Change - 10/8/2013

## Missouri State University Curricular Proposal Program Change or Deletion

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Department Physics, Astronomy, and	<u>l Materials S</u>	cience	-	DateJa	nuary 4, 2104	
Fitle of Program Affected Physics						
		Ontion	Minor	Certificate	Certification	
Type of Program: Major Comprehensive		. Option	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	_ certificate	_ Certification	
Academic Rules Other				منعما ملم الم مات		
Revised Catalog Description (cut and paste pre	sent descriptio	in from online	catalog, strike	ethrough all deletio	ns, and insert and bold new informat	tion)
A. General Education Requirements - see Ge	<u>eneral Educatio</u>	n Program an	<u>d Requirement</u>	s section of catalog		
Specific General Education Requirements	: PHY 203(5), M	<u>/ITH 261(</u> 5), <u>E</u>	<u>NG 321</u> (3)			
B. Major Requirements						
1. PHY 152(3), 204(5), 291(3), 333	3(3), <u>343(</u> 3), <u>35</u>	3(3), <u>375</u> (3), <u>3</u>	85(2), <u>386</u> (1),	391(3), <u>486</u> (1)		
2. Select one of the following optio						
		113(3), 114(4	1), or 115(4); a	nd select two course	es from: <u>AST 311(</u> 3), <u>313(</u> 3), <u>315(</u> 3), <u>3</u>	317(3)
b. Engineering and App					,	
c. Materials Physics: M						
d. Graduate Prep Physi				8)		
Related Requirements: MTH 28			<u>, , , , o, o,</u>	· /		
C. General Baccalaureate Degree Requireme	_,	, ,	ooto Dogran Pi	aquiramente caction	of catalog	
C. General baccalaureate Degree Requireme	ants - see <u>Gene</u>	rai Daccalaul	sate Degree Ki	aquilements section	of Catalog	
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Complete New Catalog Description				•	•	
A. General Education Requirements - see Ge	neral Educatio	n Program and	d Requirement	s section of catalog		
Specific General Education Req	uirements: PH	<u>/ 203(5), MTH</u>	261(5), ENG	<u>321</u> (3)		
B. Major Requirements						
1. <u>PHY 152(</u> 3), <u>204(</u> 5), <u>291(</u> 3), <u>333</u>	(3), <u>343</u> (3), <u>35</u> (	3(3), <u>375</u> (3), <u>3</u>	85(2), <u>386(1),</u>	3 <u>91</u> (3), <u>486</u> (1)		
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c. Materials Physics: M						
d. Graduate Prep Physi				a)		
3. Related Requirements: MTH 280			<u>, 170</u> (0), <u>070</u> (0	,		•
C. General Baccalaureate Degree Requireme	· ·		oato Doaroo Pa	aguizamente esction	of catalog	
C. Gerjeral baccalagreate begree Nequirerne	ilis - see <u>Gelle</u>	iai paccalaure	sale Dedice ive	equirements section	of Catalog	
5-7-1 H CO CC						
Total Hours63-66						
What is changing? Check all boxes that apply.				045.4	•	
Title change			gram (major)	Other_		
X_ Course changes of under 18 hours			or) to option			
Course changes of 18 hours or more	Program	n or option (	aeleuon	•		
Reason for Proposed Change						
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New course allowed in one option, better mat	ch between d	courses in an	other, and A	lumni advice add	ed a course to another	
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DEPARTMENT: Route according to ART VI, SE	C 3B(1-4) of	Bylaws of th	e Faculty Ser	nate. Forward th	ree typed, originally signed form	is to
one of the following (please check all that app		•	_			
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nan one committee/council, forward one ad	uitional form	i ioi each au	willonar coul	icii/ committee i	narked.	
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Professional Education Committee					ation and Educational Specialist degr	rees)
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Department Head						

(Routing on Reverse Side)

## Missouri State University Curricular Proposal Course Change or Deletion

Department Physics, Astronomy	and Materia	ls Science	Date January	3, 2013			
Check one: This is a change to	xx an existi	ng COURSE					
			rmanent) SECTION	of a variable content co	ourse		
Present Course Code and Numbe				· · · · · · · · · · · · · · · · · · ·	rai se		
Fresent Course Code and Numbe	r_PHY 123	Course Tit	le Introduction to	Physics I			
Revised Catalog Description (Copy,	/paste present	description from online ca	atalog, strikethrough al	I deletions, and insert/bold ne	ew information.		
Prerequisite: MTH 287 or eligibility for en	rollment in M7	H 261 <del>; and GIS/CSC 101 o</del>	<del>r CSC 111</del> . General Edu	ication Course (Natural World	).		
An introduction to physical theories cover help the student better understand the warrequired in this course to take PHY 124. St	ona ana now t	nese laws can be lised to a	ls, sound, and thermod make informed decision	lynamics. A knowledge of the ns to improve society. A grade	aws of Physics v		
Complete New Catalog Information	•						
Prerequisite: MTH 287 or eligibility for any	collmont in NATI	1261 Consul 54	- 4				
Prerequisite: MTH 287 or eligibility for end							
An introduction to physical theories covering the heart help the student better understand the working in this course to take PHY 124. Suppose the heart had been supposed in this course to take PHY 124.	τια απα ποψ τη	258 Iaws can be used to m	, sound, and thermody ake informed decisions	namics. A knowledge of the la to Improve society. A grade o	ws of Physics wi f "C" or better is		
What is changing? Check all boxes tha	it apply.						
□Course Deletion □Course Co		□Course Number	□Title	xxPrerequisite			
Credit Hours/Contact Hours		□Periodicity	□Description	•			
Reason for Proposed Change or Deleti	<b>on</b> some maj	ors are taking MTH 287	, which has a differe	nt prereg stream than MTH	l 261. requirin		
constant overrides.			•	, ,	. 201, 1004111		
low Did You Determine the Need For	This Change	or Deletion? Requests	from TCM and stude	ents			
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College Council	- (All subst	antive course changes nu	mbered 100-599 must	go through College Council fire	t After		
	approvai,	(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					
	committe	o the Faculty Senate if no e/council will forward two	further committee app	roval is needed. The last level es to the Faculty Senate.)	of		
Professional Education Committee	(Consider courses.)	s all substantive course ch	nanges for Professional	es to the Faculty Senate.) Education courses and Teachi	ng Methods		
Committee on General Education and Intercollegiate Programs	(Consider proposals	s all substantive course ch .)	nanges for General Edu	cation and Intercollegiate Prog	;ram		
Graduate Council	(Çonsider:	s all 600-900 level course	changes.)				
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