New Course Request **Indiana University** Indianapolis Campus

Check Appropriate Boxes: Undergraduate credit ☐ Graduate credit ☒ Professional credit ☐

1. School/Division Science / Physics 2. Academic Subject Code PHYS
3. Course Number 58500 (must be cleared with University Enrollment Services) 4. Instructor
5. Course Title Introduction to Molecular Biophysics
   Recommended Abbreviation (Optional) Intro to Biophysics
   (Limited to 32 Characters including spaces)
6. First time this course is to be offered (Semester/Year): Fall / 2010
7. Credit Hours: Fixed at 3 or Variable from to
8. Is this course to be graded S-F (only)? Yes ____ No X
9. Is variable title approval being requested? Yes ____ No X
10. Course description (not to exceed 50 words) for Bulletin publication: P: PHYS 34200 or CHEM-C360 or CHEM-C361 or CHEM-C362 or consent of instructor. Fall. Application of concepts and methods from physics to the understanding of biological systems with a focus on proteins, lipids and nucleic acids. Introduction of experimental and theoretical techniques, including X-ray crystallography, nuclear magnetic resonance and molecular dynamics simulations in the investigation of structures, forces, dynamics and energetics of these biological molecules.
11. Lecture Contact Hours: Fixed at 3 or Variable from to
12. Non-Lecture Contact Hours: Fixed at or Variable from to
13. Estimated enrollment: 10 of which 80 percent are expected to be graduate students.
14. Frequency of scheduling: Fall Will this course be required for majors? No.
15. Justification for new course: See attached document.
16. Are the necessary reading materials currently available in the appropriate library? Yes.
17. Please append a complete outline of the proposed course, and indicate instructor (if known), textbooks, and other materials.
18. If this course overlaps with existing courses, please explain with which courses it overlaps and whether this overlap is necessary, desirable, or unimportant.
19. A copy of every new course proposal must be submitted to departments, schools, or divisions in which there may be overlap of the new course with existing courses or areas of strong concern, with instructions that they send comments directly to the originating Curriculum Committee. Please append a list of departments, schools, or divisions thus consulted.

Submitted by:

Department Chairman/Division Director Date 9/24/09

Approved by:

Dean Date 10/6/09

Dean of Graduate School (when required) Date

Chancellor/Vice-President Date

University Enrollment Services Date

After School/Division approval, forward the last copy (without attachments) to University Enrollment Services for initial processing, and the remaining four copies and attachments to the Campus Chancellor or Vice-President.

UPS 724

University Enrollment Services Final—White; Chancellor/Vice-President—Blue; School/Division—Yellow; Department/Division—Pink; University Enrollment Services Advance—White

15. Justification for new course:

One of three core areas of research within the physics department is biophysics. Most entering physics graduate students do not have a good understanding of biology or biological molecules. In order to properly apply physical methods and techniques to biological systems during their graduate research these students need an introduction to these systems which illustrates and inspires points of connection between biology and physics. No single existing course provides the foundation for such research with such an emphasis on molecular structure and physical methods. A 500-level course has been chosen because this truly is an introductory graduate course and we expect that a few undergraduates with interest in biophysics may take the course.

Office of the Registrar
FORM 40G REV. 7/08

PURDUE UNIVERSITY

REQUEST FOR ADDITION, EXPIRATION,
OR REVISION OF A GRADUATE COURSE
(50000-60000 LEVEL)

Print Form

DEPARTMENT Physics

EFFECTIVE SESSION Fall 2010

INSTRUCTIONS: Please check the items below which describe the purpose of this request.

- [X] 1. New course with supporting documents (complete proposal form)
- [ ] 2. Add existing course offered at another campus
- [ ] 3. Expiration of a course
- [ ] 4. Change in course number
- [ ] 5. Change in course title
- [ ] 6. Change in course credit/type
- [ ] 7. Change in course attributes
- [ ] 8. Change in instructional hours
- [ ] 9. Change in course description
- [ ] 10. Change in course requisites
- [ ] 11. Change in semesters offered
- [ ] 12. Transfer from one department to another

PROPOSED:		EXISTING:	
Subject Abbreviation	PHYS	Subject Abbreviation	
Course Number	58500	Course Number	
Long Title	Introduction to Molecular Biophysics		
Short Title	Intro to Biophysics		

Abbreviated title will be entered by the Office of the Registrar if omitted. (30 CHARACTERS ONLY)

TERMS OFFERED
Check All That Apply:
[ ] Summer [X] Fall [ ] Spring

CAMPUS(ES) INVOLVED
[ ] Calumet [ ] N. Central
[ ] Cont Ed [ ] Tech Statewide
[ ] Ft. Wayne [ ] W. Lafayette
[X] Indianapolis

CREDIT TYPE
1. Fixed Credit: Cr. Hrs. 3
2. Variable Credit Range:
Minimum Cr. Hrs
(Check One) To [ ] Or [ ]
Maximum Cr. Hrs.
3. Equivalent Credit: Yes [ ] No [X]
4. Thesis Credit: Yes [ ] No [X]

COURSE ATTRIBUTES: Check All That Apply

1. Pass/Not Pass Only	[ ]	6. Registration Approval Type	
2. Satisfactory/Unsatisfactory Only	[ ]	Department [ ]	Instructor [X]
3. Repeatable	[ ]	7. Variable Title	[ ]
Maximum Repeatable Credit:	[ ]	8. Honors	[ ]
4. Credit by Examination	[ ]	9. Full Time Privilege	[ ]
5. Special Fees	[ ]	10. Off Campus Experience	[ ]

Schedule Type	Minutes Per Mtg	Meetings Per Week	Weeks Offered	% of Credit Allocated
Lecture	75	2	14	94
Recitation				
Presentation	75	2	1	6
Laboratory				
Lab Prep				
Studio				
Distance				
Clinic				
Experiential				
Research				
Ind. Study				
Pract/Observ				

Cross-Listed Courses

COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS):

P: PHYS 34200 or CHEM-C360 or CHEM-C361 or CHEM-C362 or consent of instructor. Fall. Application of concepts and methods from physics to the understanding of biological systems with a focus on proteins, lipids and nucleic acids. Introduction of experimental and theoretical techniques, including X-ray crystallography, nuclear magnetic resonance and molecular dynamics simulations in the investigation of the structures, forces, dynamics and energetics of these biological molecules.

Calumet Department Head	Date	Calumet School Dean	Date	Calumet Undergrad Curriculum Committee	Date
Fort Wayne Department Head	Date	Fort Wayne School Dean	Date	Fort Wayne Chancellor	Date
Indianapolis Department Head	9/24/09 Date	Indianapolis School Dean	10-8-09 Date	Undergrad Curriculum Committee	Date
North Central Department Head	Date	North Central Chancellor	Date	Date Approved by Graduate Council	
West Lafayette Department Head	Date	West Lafayette College/School Dean	Date	Graduate Council Secretary	Date
Graduate Area Committee Convener	Date	Graduate Dean	Date	West Lafayette Registrar	Date

OFFICE OF THE REGISTRAR

Supporting Document for a New Graduate Course

To: Purdue University Graduate Council

From:
Faculty Member: Andrew J. Rader
Department: Physics
Campus: Indianapolis

Date: August 1, 2009

Subject: Proposal for New Graduate Course-Documentation Required by the Graduate Council to Accompany Registrar's Form 40G

For Reviewer's comments only (Select One)

Reviewer:

Comments:

Contact for information if questions arise:
Name: Joseph Thompson
Phone Number: 317-274-0626
E-mail: jlthomp@iupui.edu
Campus Address: Science Dean's Office, LD 222; IUPUI

Course Subject Abbreviation and Number: PHYS 58500

Course Title: Introduction to Molecular Biophysics

A. Justification for the Course:

- Provide a complete and detailed explanation of the need for the course (e. g., in the preparation of students, in providing new knowledge/training in one or more topics, in meeting degree requirements, etc.), how the course contributes to existing fields of study and/or areas of specialization, and how the course relates to other graduate courses offered by the department, other departments, or interdisciplinary programs.

- Justify the level of the proposed graduate course (50000- or 60000-level) including statements on, but not limited to: (1) the target audience, including the anticipated number of undergraduate and graduate students who will enroll in the course; and (2) the rigor of the course.

B. Learning Outcomes and Method of Evaluation or Assessment:

- Describe the course objectives and student learning outcomes that address the objectives (i.e., knowledge, communication, critical thinking, ethical research, etc.).

- Describe the methods of evaluation or assessment of student learning outcomes. (Include evidence for both direct and indirect methods.)

- Grading criteria (select from dropdown box); include a statement describing the criteria that will be used to assess students and how the final grade will be determined.

Criteria Exams and Quizzes

- Identify the method(s) of instruction (select from dropdown box) and describe how the methods promote the likely success of the desired student learning outcomes.

Method of Instruction Lecture

C. Prerequisite(s):

- List prerequisite courses by subject abbreviation, number, and title.
- List other prerequisites and/or experiences/background required. If no prerequisites are indicated, provide an explanation for their absence.

D. Course Instructor(s):

- Provide the name, rank, and department/program affiliation of the instructor(s).
- Is the instructor currently a member of the Graduate Faculty? X Yes __ No
  (If the answer is no, indicate when it is expected that a request will be submitted.)

E. Course Outline:

- Provide an outline of topics to be covered and indicate the relative amount of time or emphasis devoted to each topic. If laboratory or field experiences are used to supplement a lecture course, explain the value of the experience(s) to enhance the quality of the course and student learning. For special topics courses, include a sample outline of a course that would be offered under the proposed course.

F. Reading List (including course text):

- A primary reading list or bibliography should be limited to material the students will be required to read in order to successfully complete the course. It should not be a compilation of general reference material.
- A secondary reading list or bibliography should include material students may use as background information.

G. Library Resources

- Describe the library resources that are currently available or the resources needed to support this proposed course.

H. Example of a Course Syllabus (While not a necessary component of this supporting document, an example of a course syllabus is available, for information, by clicking on the link below, which goes to the *Graduate School's Policies and Procedures Manual for Administering Graduate Student Programs.* See Appendix K.)

http://www.gradschool.purdue.edu/downloads/Graduate_School_Policies_and_Procedures_Manual.pdf

IUPUI

DEPARTMENT OF BIOLOGY

SCHOOL OF SCIENCE
A Purdue University School
Indianapolis

September 23, 2009

Andy,

It has been brought to our attention that the Department of Physics at IUPUI is planning on adding a new course in biophyics. The course, titled *Introduction to Molecular Biophysics* (physics 58500), will have a focus on proteins, lipids and nucleic acids with an introduction to experimental and theoretical techniques, including X-ray crystallography, nuclear magnetic resonance and molecular dynamics simulations in the investigation of structures, forces, dynamics and energetics of these biological molecules.

This course will enhance the undergraduate and graduate education of physics majors by applying concepts in physical sciences to biological problems, in areas in which the Department of Biology does not cover in similar depth.

For this reason, the Department of Biology supports your implementation of *Introduction to Molecular Biophysics* beginning with the Fall 2009 semester.

Best regards,

N. Douglas Lees

N. Douglas Lees
Department Chair
IUPUI – Department of Biology
723 W. Michigan Street, SL 306
Indianapolis, IN 46202
Phone: (317) 274-0588
FAX: (317) 274-2846

Introduction to Molecular Biophysics

Physics 58500 Fall 2010 Syllabus

Instructors	AJ Rader	Phone	274-6903
Office	LD154D	E-mail	ajrader@iupui.edu
Office Hours	by appointment		
Meets	TBD		

Text(s): No single required textbook. Students will be assigned review articles and chapters from several textbooks including Rob Phillips, Physical Biology of the Cell; Philip Nelson, Biological Physics 2008; Rodney Cotterill, Biophysics 2002; and Sneppen & Zocchi, Physics in Molecular Biology, 2005.

Description:

This course will introduce students to the concepts and methods of physical sciences that are applicable to the solution of biological problems. As a self-contained course (i.e. no prior biology course requirements), the intended audience is physics students at the senior undergraduate or entering graduate student level. The range of material to be covered can be classified into one of three components: concepts, techniques, or applications. The students will begin with the study of the structures, functions and interactions of proteins, biological membranes and nucleic acids. Major experimental and computational techniques to probe molecular structures, forces, dynamics and energy will be introduced. This includes X-ray crystallography, NMR and molecular dynamics simulations. A series of applications will be presented to illustrate how one can utilize various techniques to build a more comprehensive understanding of biophysical phenomena. Students will be required to select a biophysics research topic and make a presentation of this topic to the class.

Course Objectives: At the end of this course, students should be able to ...

1. Understand a research article or talk on biophysics
2. Be able to begin work in any of the biophysics research labs in the department
3. Apply physical concepts and techniques to biological systems.

Evaluation:

Midterm I (based upon the core concepts weeks 1 -4)	20%
Midterm II (based upon the core techniques weeks 5-11)	30%
Final exam (comprehensive)	30%
Oral presentation of research topic in modern biophysics	20%

Letter grades will be assigned for graduate students in the class according to the following grading scale.

Letter Grade	Minimum Percentage
A+	97
A	92
A-	90
B+	87
B	82
B-	80
C+	77
C	72

Course Outline:

WEEK	TOPIC
1	**Introduction to Biophysics**
	Introduction to Cellular Environment & Molecular Biophysics
2	**Building Blocks I: Environment & Interactions**
	Introduction to Cellular Processes & Mechanisms; Intramolecular Interactions
3	**Building Blocks II: Polymers**
	Polymers and nucleic acids; Proteins
4	**Building Blocks III: Lipids**
	Lipids: phases & composition → Membranes
5	**Measuring Structures I**
	EXAM I (over weeks 1-4) X-ray crystallography
6	**Measuring Structures & Forces**
	Circular dichroism, cryo-EM & neutron scattering, AFM & Optical tweezers
7	**Measuring Pressure & Energy**
	Osmometry, Electrophoresis and Calorimetry
8	**Time-Resolved Measurements (Spectroscopy)**
	Fluorescence and EPR
9	**Measuring Dynamics with NMR**
	Solid state & solution state NMR
10	**Computations I: molecular dynamics**
	Force fields, methods and limitations
11	**Computations II: other techniques**
	Monte Carlo & coarse-grained simulation methods
12	**Protein Folding**
	EXAM II (over weeks 5-11) Thermodynamics
13	**Folding & Misfolding**
	Kinetics & Pathways; Disorder, misfolding & aggregation
14	**Complexes & Interactions**
	Macromolecular complexes & Diffusion; Transport (Ion channels)
15	**Student Presentations**