

Copy
20-UAC Revised 1-28-2014

FORMAT 1

Submit original with signatures + 1 copy + electronic copy to Faculty Senate (Box 7500).
See <http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures/> for a complete description of the rules governing curriculum & course changes.

TRIAL COURSE OR NEW COURSE PROPOSAL

SUBMITTED BY:

Department	Physics	College/School	CNSM
Prepared by	C. P. Price	Phone	x6106
Email Contact	cpprice@alaska.edu	Faculty Contact	C. P. Price

1. ACTION DESIRED (CHECK ONE): Trial Course New Course

2. COURSE IDENTIFICATION: Dept Course # No. of Credits

Justify upper/lower division status & number of credits: **The prerequisites for this course include PHYS 421. This course will meet for twenty-eight hours.**

3. PROPOSED COURSE TITLE: **Statistical Physics**

4. To be CROSS LISTED? YES/NO If yes, Dept: Course #

NOTE: Cross-listing requires approval of both departments and deans involved. Add lines at end of form for additional required signatures.

5. To be STACKED? YES/NO If yes, Dept. Course #

How will the two course levels differ from each other? How will each be taught at the appropriate level?:

Stacked course applications are reviewed by the (Undergraduate) Curricular Review Committee and by the Graduate Academic and Advising Committee. Creating two different syllabi—undergraduate and graduate versions—will help emphasize the different qualities of what are supposed to be two different courses. The committees will determine: 1) whether the two versions are sufficiently different (i.e. is there undergraduate and graduate level content being offered?); 2) are undergraduates being overtaxed?; 3) are graduate students being undertaxed? In this context, the committees are looking out for the interests of the students taking the course. Typically, if either committee has qualms, they both do. More info online – see URL at top of this page.

6. FREQUENCY OF OFFERING:
Fall, Spring, Summer (Every, or Even-numbered Years, or Odd-numbered Years) – or As Demand Warrants

7. SEMESTER & YEAR OF FIRST OFFERING (AY2013-14 if approved by 3/1/2013; otherwise AY2014-15)

8. COURSE FORMAT:

NOTE: Course hours may not be compressed into fewer than three days per credit. Any course compressed into fewer than six weeks must be approved by the college or school's curriculum council. Furthermore, **any core course compressed to less than six weeks must be approved by the Core Review Committee.**

COURSE FORMAT: (check all that apply) 1 2 3 4 5 6 weeks to full semester

OTHER FORMAT (specify)

Mode of delivery (specify lecture, field trips, labs, etc)

9. CONTACT HOURS PER WEEK: LECTURE hours/weeks LAB hours/week PRACTICUM hours/week

Note: # of credits are based on contact hours. 800 minutes of lecture=1 credit. 2400 minutes of lab in a science course=1 credit. 1600 minutes in non-science lab=1 credit. 2400-4800 minutes of practicum=1 credit. 2400-8000 minutes of internship=1 credit. This must match with the syllabus. See <http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures-/guidelines-for-computing-/> for more information on number of credits.

OTHER HOURS (specify type)

10. **COMPLETE CATALOG DESCRIPTION** including dept., number, title, credits, credit distribution, cross-listings and/or stacking (50 words or less if possible):

Example of a **complete** description:

FISH F487 W, O Fisheries Management
3 Credits Offered Spring

Theory and practice of fisheries management, with an emphasis on strategies utilized for the management of freshwater and marine fisheries. *Prerequisites: COMM F131X or COMM F141X; ENGL F111X; ENGL F211X or ENGL F213X; ENGL F414; FISH F425; or permission of instructor. Cross-listed with NRM F487. (3+0)*

PHYS 451 "Statistical Physics" (2 credits)

The canonical ensemble; maximizing entropy, the partition function and Helmholtz free energy, the harmonic oscillator, Einstein and Debye solids, classical systems and the ideal gas, diatomic molecules, equipartition theorem, the photon gas and the blackbody spectrum, the grand canonical ensemble, quantum statistics, Fermion and Boson systems.

Prerequisites: PHYS F342, F351, F421. (2+0)

11. **COURSE CLASSIFICATIONS:** Undergraduate courses only. Consult with CLA Curriculum Council to apply S or H classification appropriately; otherwise leave fields blank.

H = Humanities S = Social Sciences

Will this course be used to fulfill a requirement for the baccalaureate core? If YES, attach form. YES: NO: X

IF YES, check which core requirements it could be used to fulfill:

O = Oral Intensive, Format 6 W = Writing Intensive, Format 7 X = Baccalaureate Core

11.A Is course content related to northern, arctic or circumpolar studies? If yes, a "snowflake" symbol will be added in the printed Catalog, and flagged in Banner.

YES NO

12. **COURSE REPEATABILITY:**

Is this course repeatable for credit? YES NO

Justification: Indicate why the course can be repeated (for example, the course follows a different theme each time).

How many times may the course be repeated for credit? TIMES
If the course can be repeated for credit, what is the maximum number of credit hours that may be earned for this course? CREDITS

If the course can be repeated with variable credit, what is the maximum number of credit hours that may be earned for this course? CREDITS

13. **GRADING SYSTEM:** Specify only one. Note: Changing the grading system for a course later on constitutes a Major Course Change - Format 2 form.

LETTER: PASS/FAIL:

RESTRICTIONS ON ENROLLMENT (if any)

14. **PREREQUISITES** PHYS 342; PHYS 351; PHYS 421; or permission of instructor.

These will be required before the student is allowed to enroll in the course.

15. **SPECIAL RESTRICTIONS, CONDITIONS**

16. **PROPOSED COURSE FEES** \$

Has a memo been submitted through your dean to the Provost for fee approval? Yes/No

17. **PREVIOUS HISTORY**

Has the course been offered as special topics or trial course previously? Yes/No

If yes, give semester, year, course #, etc.: Spring 2013 (and to be re-offered Spring 2014.)

18. ESTIMATED IMPACT

WHAT IMPACT, IF ANY, WILL THIS HAVE ON BUDGET, FACILITIES/SPACE, FACULTY, ETC.

Physics Department has offered this course once already as a Trial Course, and will be offering it again this academic year. It is part of the program offerings, and there is thus no net impact on budget, facilities/space, faculty, etc.

19. LIBRARY COLLECTIONS

Have you contacted the library collection development officer (kljensen@alaska.edu, 474-6695) with regard to the adequacy of library/media collections, equipment, and services available for the proposed course? If so, give date of contact and resolution. If not, explain why not.

No X Yes Library support is unchanged from previous (see above).

20. IMPACTS ON PROGRAMS/DEPTS

What programs/departments will be affected by this proposed action? Include information on the Programs/Departments contacted (e.g., email, memo)

No departmental or programmatic impacts.

21. POSITIVE AND NEGATIVE IMPACTS

Please specify positive and negative impacts on other courses, programs and departments resulting from the proposed action.

If this course is not offered, students will not complete the outcomes goals for the undergraduate program.

JUSTIFICATION FOR ACTION REQUESTED

The purpose of the department and campus-wide curriculum committees is to scrutinize course change and new course applications to make sure that the quality of UAF education is not lowered as a result of the proposed change. Please address this in your response. This section needs to be self-explanatory. Use as much space as needed to fully justify the proposed course.

This action will convert a successfully offered Trial Course to permanent status.

This course, and the companion course PHYS 351 "Thermal Physics", present topics in classical thermodynamics/thermal physics and in statistical mechanics in a sequence that provides better support for those topics, as follows. The curricular trend at peer and peer-aspirant institutions is to separate the two topics, as is proposed here and in the associated course proposal for PHYS 451 "Statistical Physics", and to more explicitly place the resulting topical courses within the larger curriculum. We have found that students did not have adequate success in the predecessor course, PHYS 313, in part because that course did not have sufficient prerequisites, and in part because, as national results have shown, there is typically insufficient integration of the material in the topic of classical thermodynamics/thermal physics to immediately begin study in the topic of the statistical mechanics. The changes are being proposed to raise the rate of student success in learning these topics. Absent these courses, students will not be able to achieve all of the outcomes goals for the BS Physics program.

APPROVALS: Add additional signature lines as needed.

See attached signatures

Signature, Chair, Program/Department of: _____ Date _____

Signature, Chair, College/School Curriculum Council for: _____ Date _____

Signature, Dean, College/School of: _____ Date _____

Offerings above the level of approved programs must be approved in advance by the Provost.

Signature of Provost (if above level of approved programs) _____ Date _____

18. ESTIMATED IMPACT

WHAT IMPACT, IF ANY, WILL THIS HAVE ON BUDGET, FACILITIES/SPACE, FACULTY, ETC.

Physics Department has offered this course once already as a Trial Course, and will be offering it again this academic year. It is part of the program offerings, and there is thus no net impact on budget, facilities/space, faculty, etc.

19. LIBRARY COLLECTIONS

Have you contacted the library collection development officer (kljensen@alaska.edu, 474-6695) with regard to the adequacy of library/media collections, equipment, and services available for the proposed course? If so, give date of contact and resolution. If not, explain why not.

No Yes Library support is unchanged from previous (see above).

20. IMPACTS ON PROGRAMS/DEPTS

What programs/departments will be affected by this proposed action? Include information on the Programs/Departments contacted (e.g., email, memo)

No departmental or programmatic impacts.

21. POSITIVE AND NEGATIVE IMPACTS

Please specify positive and negative impacts on other courses, programs and departments resulting from the proposed action.

If this course is not offered, students will not complete the outcomes goals for the undergraduate program.


JUSTIFICATION FOR ACTION REQUESTED

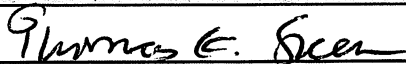
The purpose of the department and campus-wide curriculum committees is to scrutinize course change and new course applications to make sure that the quality of UAF education is not lowered as a result of the proposed change. Please address this in your response. This section needs to be self-explanatory. Use as much space as needed to fully justify the proposed course.

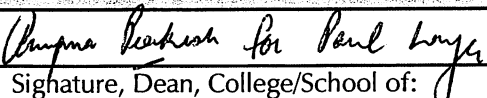
This action will convert a successfully offered Trial Course to permanent status.

This course, and the companion course PHYS 351 "Thermal Physics", present topics in classical thermodynamics/thermal physics and in statistical mechanics in a sequence that provides better support for those topics. The curricular trend at peer and peer-aspirant institutions is to separate the two topics, as is proposed here and in the associated course proposal for PHYS 351 "Thermal Physics". Absent these courses, students will not be able to achieve all of the outcomes goals for the BS Physics program.

APPROVALS: Add additional signature lines as needed.

 Date 12 JEP 2013
Signature, Chair, Program/Department of:

 Date 9-23-13
Signature, Chair, College/School Curriculum Council for: CNSM

 Date 9-24-2013
Signature, Dean, College/School of:

Offerings above the level of approved programs must be approved in advance by the Provost.

Date _____
Signature of Provost (if above level of approved programs)

ALL SIGNATURES MUST BE OBTAINED PRIOR TO SUBMISSION TO THE GOVERNANCE OFFICE

	Date	
--	------	--

Signature, Chair

Faculty Senate Review Committee: ___ Curriculum Review ___ GAAC

___ Core Review ___ SADAC

ADDITIONAL SIGNATURES: (As needed for cross-listing and/or stacking)

	Date	
--	------	--

Signature, Chair, Program/Department of:

	Date	
--	------	--

Signature, Chair, College/School Curriculum Council for:

	Date	
--	------	--

Signature, Dean, College/School of:

Statistical Physics

PHYSICS 451 – Spring 2015

Syllabus

Instructor: Channon Price, REIC 120, x6106, cpprice@alaska.edu

Office Hours: TBD

Class meets: TBD (times [equalling two hours per week], days of week, location)

Credits: 2 credits.

Prerequisites: PHYS F342, PHYS F351, PHYS F421.

Text: Intro. to Statistical Mechanics, by Bowley and Sanchez, Oxford, 2nd ed; ISBN 978-0198517948

Course Description: The canonical ensemble; maximizing entropy, the partition function and Helmholtz free energy, the harmonic oscillator, Einstein and Debye solids, classical systems and the ideal gas, diatomic molecules, equipartition theorem, the photon gas and the blackbody spectrum, the grand canonical ensemble, quantum statistics, Fermion and Boson systems. This course covers the second half of the topics of the statistical mechanics, and is required for the BS Physics program.

Grading: The course grade will be based upon the following weighting:

Participation in Recitation	10%
Homework	20%
Quizzes	10%
Mid-Term Exam	20%
Final Exam	40%

On Assessments: There will be a homework assignment each week. The assignments are due one week after they are assigned. Thus, a homework assigned on a Wednesday is due the following Wednesday. The homework assignments will be posted on this web site as well as in the glass hallway case assigned to this class. You are encouraged to work with others on the homework but the work you turn in should be your own. Verbatim copies are easily detected and will result in both papers receiving a zero. (See the section on plagiarism below.) Several short quizzes will be given during classtime throughout the semester. They will be closed book and no calculators will be allowed (or needed!). There will be one mid-term exam (Friday, 8 March 2013) and one final exam. The mid-term exam will be a one-hour, closed book exam given during regular class time. The final exam will be held according to the published UAF schedule. Make-up exams are considered only in the event of documented inability to take the examination with the rest of the class.

Instructional Methods: This is primarily a lecture course, but one half hour of the second class meeting of each week will be used for recitation. The purpose of the recitation is to provide the students with an opportunity to explore the lectures and homeworks further. It is intended that the recitation will be in the form of a group discussion of topics introduced by the students.

Preparation for the course: completion of PHYS 351 (a prerequisite) should prepare the student to understand the details of thermodynamics; completion of PHYS 421 should prepare the student to understand the basis for quantum statistics.

Learning Outcomes: Students who complete PHYS 451 will understand the concept of the ensemble in the construction of the statistical mechanics, will appreciate the connection between the equilibrium distribution, the condition of maximum entropy, and the canonical ensemble, will understand the construction and use of the partition function, will be able to calculate the classical thermodynamics of the ideal gas from the free particle partition function, will have been exposed to advanced topics such as the equipartition theorem, the quantum statistics, and the grand partition function, and will have seen application of the statistical mechanics to the photon gas and the degenerate electron gas.

Course Goals: Students will learn the physical principles of the statistical mechanics and the basis for the equations of state of both classical and quantum many particle systems.

Support Services: As this course is intended for upper division Physics majors, support services for the students in the course are provided during the instructor's office hours.

Special Needs: The Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials. We will work with the Office of Disabilities Services (203 WHIT, 474-7043) to provide reasonable accomodation to students with disabilities.

Plagiarism: Plagiarism and cheating are serious matters for students and academic institutions. The UAF Honor Code (or Student Conduct Code) defines the academic standards expected at the University of Alaska and which will be followed in this class. The Code reads, in part:

"Students will not collaborate on any quizzes, in-class exams, or take-home exams that will contribute to their grade in a course, unless permission is granted by the instructor of the course. Only those materials permitted by the instructor may be used to assist in quizzes and examinations. Students will not represent the work of others as their own. A student will attribute the source of information not original with himself or herself (direct quotes or paraphrases) in compositions, theses and other reports. Not work submitted for one course may be submitted for credit in another course without the explicit approval of both instructors. Violations of the Honor Code will result in a failing grade for the assignment and, ordinarily, for the course in which the violation occurred. Moreover, violation of the Honor Code may result in suspension or expulsion."

Calendar:

Week / Lecture topics

1. Review of Classical Thermodynamics
2. Review of Probability and Statistics
3. Introduction to Statistical Mechanics
4. The Canonical Ensemble, I (Stirling's approximation)
5. The Canonical Ensemble, II (partition function; free energy)
6. Application: Rotational/Vibrational Energies of Molecules
7. Phase space, density of states
8. Planck's distribution, photon gas
9. Fermions and Bosons: the impact of QM
10. Fermi statistics; the Fermi gas
11. Electrons in metals; degenerate Fermi gases in astrophysics
12. Bose statistics; the Boson gas
13. Phase transitions
14. Applied topics: superconductivity, superfluidity, Bose-Einstein condensates