PURDUE UNIVERSITY
REQUEST FOR ADDITION, EXPIRATION,
OR REVISION OF AN UNDERGRADUATE COURSE
(10000-40000 LEVEL)

DEPARTMENT: Physics
EFFECTIVE SESSION: Spring 2011

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

- [X] 1. New course with supporting documents
- 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 (department head signature only)
- 8. Change in instructional hours
- 9. Change in course description
- 10. Change in course requisites
- 11. Change in semesters offered (department head signature only)
- 12. Transfer from one department to another

PROPOSED:
Subject Abbreviation: PHYS
Course Number: 41500
Long Title: Thermal and Statistical Physics
Short Title: Thermal Physics

EXISTING:
Subject Abbreviation: PHYS
Course Number: 41500
Long Title: Thermal and Statistical Physics
Short Title: Thermal Physics

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

CAMPUSES INVOLVED:
- Calumet
- Fort Wayne
- Indianapolis
- N. Central
- Tech Statewide
- W. Lafayette

Abbreviated title will be entered by the Office of the Registrar if omitted. (20 CHARACTERS ONLY)

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

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

Schedule Type
- Lecture
- Recitation
- Presentation
- Laboratory
- Lab Prep
- Studio
- Distance
- Clinic
- Experimental
- Research
- Ind. Study
- Pract/Observ

Minutes Per Week: 50
Meetings Per Week: 3
Weeks Offered: 15
% of Credit Allocated: 100

COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS):
Temperature, equations of state, first and second laws of thermodynamics, entropy and applications, kinetic theory, transport processes, statistical mechanics.
Prerequisites: Phys 342

*COURSE LEARNING OUTCOMES:
Students will understand basic thermal processes in light of statistical mechanics.

CALUMET DEPARTMENT HEAD: [Signature] Date: 10/4/12
FORT WAYNE DEPARTMENT HEAD: [Signature] Date: 10/16/12
INDIANAPOLIS DEPARTMENT HEAD: [Signature] Date: 
NORTH CENTRAL FACULTY SENATE CHAIR: [Signature] Date: 
WEST LAFAYETTE DEPARTMENT HEAD: [Signature] Date: 

OFFICE OF THE REGISTRAR

[Signature]
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Physics 415 Tentative Syllabus

Statistical and Thermal Physics

Class times: 4:30 – 5:45pm, KT133, Mondays and Wednesdays
Text: "Statistical and Thermal Physics, With Computer Applications" by Harvey Gould and Jan Tobochnik
Instructor: Stephen D. Gillam, Ph.D.
Office: KT 122A
Phone: 481-6150
email: gillamsd@ipfw.edu
Office hours: Tues. and Thurs. 3:00 pm – 4:00 pm, Wed. 11:00 – noon.

My goal for this class is that you end the quarter with an understanding of thermodynamics and statistical mechanics.

Simulations: The course will use simulations provide by the Statistical and Thermal Physics Project to investigate and understand important concepts and processes. These are freely available at http://www.compadre.org/OSP/document/ServeFile.cfm?ID=7308&DocID=481
Click on the osp_stp.jar link. You will need Java on your PC or Mac. These programs will not run on an ipad.

The textbook is available electronically from the bookstore and other vendors.

Tentative Schedule of Topics

From Macroscopic to Microscopic Behavior (Chp. 1)
  Doing work and the Quality of Energy
  Measuring Pressure and Temperature
  Work, Heating and the First Law of Thermodynamics
  Time and Ensemble Averages
  Models of matter

Thermodynamic concepts and processes (Chp. 2)
  The System
  Thermodynamic equilibrium and temperature
  Equations of State
  Thermodynamic processes
  The First Law of Thermodynamics
  Heat Capacities and Enthalpy
  The Second Law of Thermodynamics
  Heat Engines, Heat Pumps and Refrigerators
Entropy Changes
The Third Law of Thermodynamics
Free Energies

Concepts of Probability (Chp. 3)
The rules of Probability
Mean Values
The Meaning of Probability
Probability Distributions and Some Applications

The Methodology of Statistical Mechanics (Chp. 4)
Counting Microstates
The Microcanonical Ensemble
The Canonical Ensemble
The Connection Between Thermodynamics and Statistical Mechanics
The Grand Canonical Ensemble
Entropy is not a Measure of Disorder

Many-Particle Systems (Chp. 6)
The Ideal Gas in the Semi-Classical Limit
Classical Statistical Mechanics
Occupation Number
Distribution Functions
Density of States
The Equation of State of an Ideal Classical Gas
Blackbody Radiation
The Ideal Fermi Gas
Bose Condensation

The Chemical Potential and Phase Equilibria (Chp. 7)
The Meaning of The Chemical Potential
Measuring the Chemical Potential in Simulations
Phase Equilibria
The Van der Walls equation of State
Chemical Reactions

**Homework** will be due by the start of the class after it is assigned. Homework handed-in late will NOT be accepted.

**Exams** will be oral and up to 15 minutes in duration. The best way to prepare for these is to discuss the material in class, among your selves, and with me at every opportunity.
Research You are required to carry out a research project from the list below:
   a. Investigate the Mpemba effect,
   b. measure the efficiency of a thermoelectric (Peltier) heat pump,
   c. measure the Joule-Thompson coefficient of carbon dioxide.

You will design and setup the necessary apparatus, take the measurements, and write a short report (4-10 pages) on your research. This will be due November 26. This will be graded. You may work in pairs (and will probably have to) but you must write your own report.

Extra credit will be awarded for a small computational project illustrating a thermodynamic or statistical mechanical phenomenon of interest to you. The results of this project will be demonstrated or reported in class November 5.

Evaluation

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<tr>
<td>Midterm exam</td>
<td>Oct. 8 or Oct. 10</td>
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<td>Final exam</td>
<td>Dec. 10 or Dec 12</td>
<td>25%</td>
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<tr>
<td>Research</td>
<td>Report due Nov. 26</td>
<td>20%</td>
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<tr>
<td>Homework</td>
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<tr>
<td>Extra credit</td>
<td>Demo due Nov. 5</td>
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An “A” grade can be achieved without the extra credit.

Grades

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Note: You must devote the time to read the relevant parts of the textbook prior to class and devote enough time to solve the homework problems.