

# NIU Course Syllabus for Physics 320

## THERMODYNAMICS AND STATISTICAL PHYSICS

**Fall Semester, 2017, Tuesday and Thursdays, 3:30-4:45 pm**

### Course Description:

Concept and measurement of temperature. Study of the first and second laws of thermodynamics, entropy, and the statistical theory of simple systems. (In this course, we focus on the classical thermodynamics.)

**Prerequisites** : MATH 232 and PHYS 260 or PHYS 261 or PHYS 283.

**Credits**: 3

### Course Goals:

1. Develop logical, objective, and critical thinking with scientific method using classical thermodynamics.
2. Develop the relationship between heat, work/energy, and potentials.
3. Develop advanced quantitative analysis skills and methods with advanced calculus and partial differential equations.

**Student Learning Outcomes:** Upon successful completion of the course, with advanced calculus and partial differential equations, students will be able to explain, analyze and/or apply:

- The first law of thermodynamics.
- The second law of thermodynamics with entropy.
- The thermodynamic potentials such as Gibbs function and Helmholtz function through Legendre transformations.
- The third law of thermodynamics.
- The Kinematic theory of gases. This is a bridge to statistical mechanics.

**Class room:** FR238

**Instructor:** Yasuo Ito. La Tourette 218 and/or 101 (Electron Microscopy Lab)

Tel: 815-753-6477

e-mail: [yito@niu.edu](mailto:yito@niu.edu) (preferred)

**Office Hours:** Tuesdays, and Thursdays, 2:00 pm – 3:00 pm; Other hours by an appointment.

**Text book:** Classical and Statistical Thermodynamics, A. H. Carter (required). Other references such as “*Heat and thermodynamics*” by Zemansky (out of print).  
Please read your textbook before coming to the class!!

**The view graphs, homework assignments and their solutions will be posted on the Blackboard web course. Therefore, it is essential for you to familiarize with the Blackboard web course.**

**Grading (tentative):**

**5% Attendance.** Attendance is **MANDATORY**. A student will receive attendance points if the student attends more than or equal to 85% of the course (25 out of 30 classes), according to the attendance rate. Perfect attendance will receive extra credit points. Students will not receive attendance points if he/she misses 6 - 9 classes. Students will receive **Negative** attendance points if he/she misses class more than 9 classes, **(-1/class)**.

**40% Homework** **ESSENTIAL** Due one week of posting (Late penalty policy: 10% off)

**25% Midterm Exams** **Thursday September 28th and November 2nd in class.**

**30% Final Exam** (comprehensive) **Tuesday December 12th**, 4:00 pm – 5:50 pm.

To pass this course, you must score at least **50%** on the homework **AND** at least **50%** overall.

**Grading scale:**

A ( $90 \leq x$ ), A- ( $85 \leq x < 90$ ), B+ ( $80 \leq x < 85$ ), B ( $75 \leq x < 80$ ), B- ( $70 \leq x < 75$ ), C+ ( $65 \leq x < 70$ ), C ( $55 \leq x < 65$ ), D ( $50 \leq x < 55$ ), F ( $x < 50$ ).

**Grade points** (assigned by University):

A (4.00), A- (3.67), B+ (3.33), B (3.00), B- (2.67), C+ (2.33), C (2.00), D (1.00), F (0.00).

**Class Policies:**

*Americans with Disabilities Act:* If you need an accommodation for this class, please contact the Disability Resource Center as soon as possible. The DRC coordinates accommodations for students with disabilities. It is located on the 4th floor of the Health Services Building, and can be reached at 815-753-1303 or [drc@niu.edu](mailto:drc@niu.edu). Also, please contact me privately as soon as possible so we can discuss your accommodations. The sooner you let **us** know your needs, the sooner **we** can assist you in achieving your learning goals in this course.

*Class Visitation Policy:* Due to liability concerns, only NIU students are allowed to attend at classes at NIU. Guests, including family members and NIU students not registered for the course, will not be permitted to attend class except with prior arrangement with the educator. Because university classes are not developmentally appropriate situations for young children, children will not be allowed in class except in highly unusual circumstances and with the prior approval of the educator.

*Academic Misconduct:* For a detailed description of the university's definition of academic misconduct, and the process by which it is adjudicated, please refer to the Student Code of Conduct. Sanctions (consequences) for committing academic misconduct include but are not limited to, failure of the assignment, failure of the course, and suspension or expulsion from Northern Illinois University. Cheating and plagiarism of one's own or another's work will not be tolerated. Academic integrity and civility in the classroom are expected of every member of the NIU community. Please review the *Undergraduate Catalog* for more information on this topic.

*Syllabus Clause and Contract:* This syllabus may be revised and adapted throughout the semester to better serve the needs of the class. The decision to remain in this class upon receipt of the syllabus serves as students' acceptance of the syllabus as a binding contract, meaning they agree with the terms set forth and the expectations of them as members of the class.

*Religious Observances:* Northern Illinois University, as a public institution of higher education in the State of Illinois, does not observe religious holidays. It is the university's policy, however, to reasonably accommodate the religious observances of individual students in regards to class attendance, scheduling

examinations, and work requirements. Such policies shall be made known to faculty and students. Religious observance includes all aspects of religious observance and practice as well as belief. Absence from classes or examinations for religious observance does not relieve students from responsibility for any part of the course work required during the period of absence. To request accommodation, students who expect to miss classes, examinations, or other assignments as a consequence of their religious observance shall provide educators with reasonable notice of the date or dates they will be absent.

**Helpful Resources:**

*ACCESS Tutoring and Support Services* (Access to Courses and Careers through Educational Support Services) provides students with several resources for academic assistance. The ACCESS Tutoring and Support Services website ([www.niu.edu/access](http://www.niu.edu/access)) offers a complete listing of campus resources for tutoring and other academic services available.

*Physics Help Room.* The physics help room is located in FR 251 and is open M-Th 9-5, F 9-3.

*University Writing Center:* All students are entitled and encouraged to use the Writing Center in Stevenson Tower South, Lower Level, as a resource for improving their written work. Contact tutors and schedule appointments by walking in, calling 753-6636, or going to [www.niu.edu/uwc/](http://www.niu.edu/uwc/).

**(Tentative schedule)** *subject to change, depending on the progress of the class*

**0: Introduction to the course** August 29, 2017.

**1: The Nature of Thermodynamics** August 31, 2017

**2: Equations of State** (and a bit of 11: *The Kinetic Theory of Gases*)

**3: The First Law of Thermodynamics** (and Appendix A)

**4: Applications of the First Law**

**Mid-Term I:** September 28th 1st, Final due date for Homework Ch1, Ch2, Ch3, A1, Ch4

**5: Consequences of the First Law**

**6: The Second Law of Thermodynamics**

**7: Applications of the Second Law**

**Mid-Term II:** November 2nd, Final due date for Homework Ch5, Ch6, Ch7

**8: Thermodynamic Potentials**

**9: Chemical Potential and Open Systems**

**10: The Third Law of Thermodynamics**

**(12: *Statistical Thermodynamics*)**

**May 3<sup>rd</sup>,** Final due date for Homework Ch8, Ch9, Ch10

**Final Exam** (Tuesday, December 12th, 2017, 4:00 – 5:50 pm)