Statistical Physics II

Course Information

Course Number: 4P71/5P70
Term/Year/Duration: Winter, 2024-25
Course Title: Statistical Physics II

Instructor Information

Instructor Name: Dr. Ganesh Ramachandran
Email: r.ganesh@brocku.ca
Office Location: MCB 207

Times and Locations

Lectures: Tuesdays 3-4.30 p.m. at MCJ 404, Wednesdays 3.30-5 p.m.at WH303

Instructor office Hours: Drop-in at MCB207/by appointment

Course Calendar Description

Fundamental postulates, equilibrium statistical mechanics and its relation to thermodynamics. Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics are derived and applied in appropriate physical situations of non-interacting and interacting particles; fluctuations; elementary treatment of transport theory.

Suggested Readings or Texts

Notes will be provided by instructor. No textbook is necessary.

Optional additional reading material:

Statistical Mechanics, R K Pathria

Fundamentals of Statistical and Thermal Physics, F. Reif

Essential Statistical Physics, M P Kennett

Course Communications

Communications will be sent using Brightspace's announcement feature. Students may submit their content questions via Brightspace's message feature.

Evaluation

Assessment Component	Grade Weight
5 Problem sets	20%
Midterm	30%
Presentation	10%
Final Exam	40%
Total	100%

Task Descriptions

Problem Sets: Assignments will be posted on Brightspace. Students are encouraged to collaborate/discuss with one another when solving problem sets. They

Final Exam: The final exam will test all the material covered in the course. **You must pass the final exam (50% or more) in order to pass the course.**

Late Submission Policy

Problem Sets: The due date for each problem set will be posted on Brightspace. Late submissions will not be accepted, unless previously approved by the instructor.

Requirements for attendance and participation:

Lectures: There is no requirement to attend lectures. Students are strongly encouraged to attend every lecture and to participate in discussions.

Important dates for Winter 2024-25 (D3)

The most recent listing of Important Dates for all durations is at https://brocku.ca/important-dates/all/

First day of classes: 6 January

Last day of lectures: 4 April

Reading Week: 17-21 February

Academic Policies

Academic Integrity

Statement for undergraduate courses

Academic misconduct is a serious offence. The principle of academic integrity, particularly of doing one's own work, documenting properly (including use of quotation marks, appropriate paraphrasing and referencing/citation), collaborating appropriately, and avoiding misrepresentation, is a core principle in university study. Students should consult Section VII, "Academic Misconduct", in the "Academic Regulations and University Policies" entry in the Undergraduate Calendar to view a fuller description of prohibited actions, and the procedures and penalties. Information on what constitutes academic integrity is available at Brock University Academic Integrity Website.

Penalties for Academic Misconduct in the Faculty of Mathematics and Science:

The following are minimum penalties usually imposed in academic misconduct cases in FMS. Please be aware that the Associate Dean, Undergraduate Programs, may assign different penalties than those listed here, depending on the details of individual cases. Also note that cheating on exams carries significantly higher penalties.

First offence: Zero grade on assignment, additional penalty of 100% of the weight of the assignment to be subtracted from the final grade, mandatory completion of the AZLS Academic Integrity workshop

Second offence: Zero grade on assignment, additional penalty of 200% of the weight of the assignment to be subtracted from the final grade, 4-month suspension

Third or additional offence: Zero grade in course, 1-year suspension, permanent removal from major program.

Cheating on exams: Zero grade in course, including for first offence.

Intellectual Property Notice

All slides, presentations, handouts, tests, exams, and other course materials created by the instructor in this course are the intellectual property of the instructor. A student who publicly posts or sells an instructor's work, without the instructor's express consent, may be charged with misconduct under Brock's Academic Integrity Policy and/or Code of Conduct, and may also face adverse legal consequences for infringement of intellectual property rights.

Accommodations

The University is committed to fostering an inclusive and supportive environment for all students and will adhere to the Human Rights principles that ensure respect for dignity, individualized accommodation, inclusion and full participation. The University provides a wide range of resources to assist students, as follows:

a) If you require academic accommodation because of a disability or an ongoing health or mental health condition, please contact Student Accessibility Services at askSAS@brocku.ca or 905 688 5550 ext. 3240.

b) Medical Self-Declaration Forms (brief absence up to 72 hours)

In the case of a short-term medical circumstance, if a student wishes to seek an academic consideration, please use the Medical Self-Declaration Form. The request is to be made in good faith by the student requesting the academic consideration due to a short-term condition that impacts their academic activities (e.g., participation in academic classes, delay in assignments, etc.).

The period of this short-term medical condition for academic consideration must fall within a 72-hour (3 day) period. The form must be submitted to the instructor either during your brief absence or if you are too unwell, within 24 hours of the end of your 3 day brief absence.

Medical Verification Form (extended duration)

In cases where a student requests academic consideration due to a medical circumstance that exceeds 72 hours (three days) and will impact their academic activities (e.g., participation in academic classes, delay in assignments, etc.), or in the case of a final exam deferral, the medical verification form must be signed by the student and the health professional as per process set out in the Faculty Handbook III:9.4.1.

c) If you are experiencing mental health concerns, contact the Student Wellness and Accessibility Centre. *Good2Talk* is a service specifically for post-secondary students, available 24/7, 365 days a year, and provides anonymous assistance: Good 2 Talk or call **1-866-925-5454**. For information on wellness, coping and resiliency, visit: Brock University (Mental Health)

d) If you require academic accommodation on religious grounds, you should make a formal, written request to your instructor(s) for alternative dates and/or means of satisfying requirements. Such requests should be made during the first two weeks of any given academic term, or as soon as possible after a need for accommodation is known to exist.

e) If you have been affected by sexual violence, the Human Rights & Equity Office offers support, information, reasonable accommodations, and resources through the Sexual Violence Support & Education Coordinator. For information on sexual violence, visit Brock's Sexual Assault and Harassment Policy or contact the Sexual Violence Support & Response Coordinator at humanrights@brocku.ca or 905 688 5550 ext. 4387.

f) If you have experienced discrimination or harassment on any of the above grounds, including racial, gender or other forms of discrimination, contact the Human Rights and Equity Office at humanrights@brocku.ca.

Outline

- Microscopic and macroscopic physics
- Notion of phase space
- Ensemble and ergodic hypotheses
- Microcanonical ensemble
- Canonical ensemble
    - Curie Law
- Grand canonical ensemble
    - Ideal gas
- Statistical mechanics of quantum systems
- Fock space
- Fermi gas
    - Sommerfeld expansion
    - Neutron stars
- Bose gas
    - Photon gas and blackbody radiation