UNIVERSITY OF THE FRASER VALLEY

COURSE IMPLEMENTATION DATE:	January 1995
COURSE REVISED IMPLEMENTATION DATE:	May 2014
COURSE TO BE REVIEWED:	May 2020
(six years after UEC approval)	*(month, year)*

OFFICIAL UNDERGRADUATE COURSE OUTLINE INFORMATION

Students are advised to keep course outlines in personal files for future use.
Shaded headings are subject to change at the discretion of the department – see course syllabus available from instructor

PHYS 311	Faculty of Science / Physics	3
COURSE NAME/NUMBER	FACULTY/DEPARTMENT	UFV CREDITS

Statistical Physics
COURSE DESCRIPTIVE TITLE

CALENDAR DESCRIPTION:

Basic statistics and statistical distributions (Binomial, Gaussian, and Poisson); statistical description of particle interactions and equilibrium, phase space, and the number of microstates; micro canonical, canonical, and grand canonical distributions; partition functions, entropy, and the Boltzmann factor; quantum statistics, Fermi-Dirac, and Bose-Einstein systems.

PREREQUISITES:	PHYS 231. Note: As of May 2015, prerequisites will change to the following: (PHYS 231) and (one of PHYS 221 or PHYS 381).
COREQUISITES:	
PRE or COREQUISITES:	

SYNONYMOUS COURSE(S):
(a) Replaces: ____________
(b) Cross-listed with: ____________
(c) Cannot take: ____________ for further credit.

SERVICE COURSE TO: *(department/program)*

TOTAL HOURS PER TERM: **75**

STRUCTURE OF HOURS:

Lectures:	**75**	Hrs
Seminar:		Hrs
Laboratory:		Hrs
Field experience:		Hrs
Student directed learning:		Hrs
Other (specify):		Hrs

TRAINING DAY-BASED INSTRUCTION:
Length of course:
Hours per day:

OTHER:
Maximum enrolment: **24**
Expected frequency of course offerings: Once every two years
(every semester, annually, every other year, etc.)

WILL TRANSFER CREDIT BE REQUESTED? (lower-level courses only)	☐ Yes	☐ No
WILL TRANSFER CREDIT BE REQUESTED? (upper-level requested by department)	☐ Yes	☒ No
TRANSFER CREDIT EXISTS IN BCCAT TRANSFER GUIDE:	☐ Yes	☒ No

Course designer(s):	**Rob Woodside (revised by Jeff Chizma)**		
Department Head:	**Derek Harnett**	Date approved:	**August 26, 2013**
Campus-Wide Consultation (CWC)		Date of meeting:	**September 27, 2013**
Curriculum Committee chair:	**David Fenske**	Date approved:	**October 18, 2013**
Dean/Associate VP:	**Lucy Lee**	Date approved:	**October 18, 2013**
Undergraduate Education Committee (UEC) approval		Date of meeting:	**January 31, 2014**

LEARNING OUTCOMES:

Upon successful completion of this course, students will be able to:

- Apply basic statistical techniques to simple systems (like dice, coins etc) to make predictions on various outcomes
- Derive the Gaussian and Poisson distributions as limiting cases of the Binomial distribution
- Demonstrate the applicability of statistical methods to systems of large numbers of particles
- Explain the difference between the micro-canonical, canonical, and grand-canonical distributions, and be able to perform calculations with these distributions
- Calculate temperatures and pressures based on maximizing the number of microstates
- Perform phase space calculations within the micro-canonical distribution for various systems, including ideal gases and simple extensions
- Utilize the partition function to calculate internal energy, entropy, and other important thermodynamic quantities
- Show how the number of microstates is related to the partition function
- State the importance of the chemical potential for quantum systems
- Provide explanations for the difference between quantum and classical statistical distributions
- Extend the Boltzmann factor calculations to include Fermi-Dirac and Bose-Einstein systems
- Validate the connection between the theoretical basis of Statistical Mechanics and the empirical laws of Thermodynamics

METHODS: *(Guest lecturers, presentations, online instruction, field trips, etc.)*

This course will be taught using lectures, demonstrations, seminars and student projects. Problems will be assigned and marked on a regular basis.

METHODS OF OBTAINING PRIOR LEARNING ASSESSMENT RECOGNITION (PLAR):

☐ Examination(s) ☐ Portfolio assessment ☐ Interview(s)

☒ Other (specify): Please see the Physics PLAR policy on the department's webpage

☐ PLAR cannot be awarded for this course for the following reason(s):

TEXTBOOKS, REFERENCES, MATERIALS:

[Textbook selection varies by instructor. An example of texts for this course might be:]

Fundamentals of Statistical and Thermal Physics, F. Reif, Waveland Press (2008)

SUPPLIES / MATERIALS:

STUDENT EVALUATION:

[An example of student evaluation for this course might be:]

Assignments:	30%
Term test:	20%
Project or presentation:	10%
Final exam:	40%

COURSE CONTENT:

[Course content varies by instructor. An example of course content might be:]

1. **Overview of Basic Statistics**
   - Binomial, Gaussian, and Poisson distributions, mean, median, variance and standard deviations, random walk in 1 dimension

2. **Application of Statistics to Physical Systems**
   - Micro canonical and canonical distributions, counting microstates, phase space, density of states, derivation of the Boltzmann distribution, equilibrium values

3. **Connection with Thermodynamics**
   - Pressure, temperature, and entropy as related to microstates, partition function, chemical potential, ideal gas and Van der Waals equations of state, equipartition theorem

4. **Quantum Statistics**
   - Quantum counting, fermions, and Fermi-Dirac statistics, bosons and Bose-Einstein statistics, grand partition function, relationship between the chemical potential and the number of particles, photon gas, and blackbody radiation, third law of thermodynamics