אוניברסיטת
בן-גוריון בנגב

The Department of Mathematics

2022–23–A term

Course Name Thermodynamics and Stat. Mech. 1

Course Number 203.1.2161

Course web page
`https://www.math.bgu.ac.il//en/teaching/fall2023/courses/thermodynamics-and-stat`

Office Hours `https://www.math.bgu.ac.il/en/teaching/hours`

Abstract

Requirements and grading[1]

Course topics

Main concepts of Statistical Physics: separation of microscopic and macroscopic description of a system; microstates vs. configurations; sharpness of the distribution of microstates over configuration space; basic idea of statistical ensembles and of probabilities. Main concepts of Statistical Physics as applied to a simple modelsystem of two-state spins: numbering of microscopic states; multiplicity function; continuous approximation of the multiplicity function; probabilities of micro- and macro- states; characteristics of probability function, mean, variance and standard deviation; sharpness of the probability distribution of a macroscopic variable; correlation of two random variables. Microcanonical ensemble: probabilities of microscopic states in an isolated system at equilibrium; example of equilibration in the system of spins; thermal equilibrium of two arbitrary systems; definition of temperature; entropy in microcanonical ensemble; additivity of entropy; the postulate of entropy increase in an isolated system (second Law of Thermodynamics); the direction of heat flow. Canonical ensemble: Boltzmann Distribution; partition function; microscopic state probabilities; average energy of a system in thermal equilibrium; fluctuations in energy and their relation to heat capacity; Helmoholtz Free energy and its relation to the partition function. Applications of the canonical ensemble: the system of spins; Schottky anomaly; partition function, energy and free energy of a classical ideal monoatomic gas.

[1] Information may change during the first two weeks of the term. Please consult the webpage for updates

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Thermodynamic equilibrium and thermodynamic processes; characteristic time scales; reversible and irreversible processes; quasi-stationary process; examples of quasi-stationary heat transfer and of work. Heat and Work in thermodynamics; First Law of Thermodynamics; dffierential relations between thermodynamic quantities; Maxwell relations; enthalpy; heat capacity; intensive and extensive quantities; entropy, pressure and heat capacity of a classical ideal