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Graduate Program in Physics
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Statistical Mechanics I

Course code: FSC410131

Credit hours: 6

Duration: 18 weeks

DESCRIPTION: Microcanonical, canonical and grand-canonical ensembles. Quantum ideal gases. Phase transitions. Mean field approximation. Scaling theory. Kinetic theory. Langevin equation. Fokker-Planck equation.

COURSE CONTENT:

1. Ensemble theory: Microcanonical, canonical and grand-canonical ensembles. Partition function. Calculation of thermodynamic properties. Fluctuations. Statistics of quantum systems. Density matrix. Quantum ideal gases. Statistics of Bose-Einstein and Fermi-Dirac and their applications.

2. Study of interacting systems and phase transitions: Thermodynamics of phase transitions. Critical exponents. Viral expansion. Van der Waals gas. Liquid-gas transition. Ising model. Mean field theory. Applications of mean field approach. Landau's theory. Order and Symmetry. Scaling theory.

3. Systems out of equilibrium: Kinetic theory. Boltzmann equation. Theorem H. Transport Phenomena. Brownian Motion and Langevin equation. Fokker-Planck equation. Fluctuation-Dissipation Theorem.

Bibliography

Statistical Mechanics. R.K. Pathria and P. D. Beale, Third Edition, Academic Press, 2011.

Statistical Mechanics. Huang Kerson, Second Edition, John Wiley and Sons, 1987.

A Modern Course in Statistical Physics. Linda Reichl, Fourth Edition, Wiley-VCH, 2016.

Statistical Physics of Particles. Mehran Kardar, First edition, Cambridge University Press, 2007.

Statistical Physics of Fields. Mehran Kardar, First edition, Cambridge University Press, 2007.