UNIVERSITATEA DIN BUCUREȘTI
VIRTUTE ET SAPIENTIA

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## *Tematica pentru concursul de Conferenţiar universitar, poziţia 14, Departamentul de Structura materiei, Fizica atmosferei şi a Pământului, Astrofizică*

**Tematica de concurs**

1. Introducere în modelarea şi simularea fenomenelor fizice. Elemente de simulare şi modelare în fizica stării condensate. Tipuri de simulări.
2. Rezolvarea problemelor legate de memoria sistemului de calcul şi de timpul de rulare. Condiţii de frontieră libere, constrânse si periodice. Tipuri de potenţiale de interacţie între particule.
3. Simulări pe calculator în fizica starii condensate. Principiul metodei.
4. Simulări în diverse ansambluri statistice: microcanonic, canonic, izoterm-izobar şi grand-canonic.
5. Simulări Monte Carlo în cazul sistemelor macromoleculare.
6. Simularea proceselor de cristalizare a polimerilor.
7. Numere complexe. Aplicații.
8. Elemente de calcul diferențial – diferențiale, derivate, derivate derivate parțiale.
9. Ecuații diferențiale.
10. Spații vectoriale.

**Bibliografie**

1. D. Frenkel, B. Smit, "Understanding Molecular Simulations. From Algorithm to Applications.", Academic Press, New York, 2002;
2. M.P. Allen, D.J. Tildesley, "Computer Simulation of Liquids", Oxford University Press, 1989;
3. D. P. Landau, K. Binder, "A Guide to Monte Carlo Simulations in Statistical Physics", Cambridge University Press, 2000;
4. L. Georgescu, V. Popa-Niţă, E. Barna, C. Berlic, "Fizica Cristalelor Lichide. Aplicaţii", Editura Universităţii din Bucureşti, 2002;
5. J.M. Coulson and J.F. Richardsson, Chemical Engineering, Vol. 1, Pergamon Press, 1990,appendix.
6. B. Sundén, "Kompendium i Värmeöverföring," Department of Heat Transfer,LTH, Lunds University, Sweden, p. 137, 2004 (in Swedish).
7. K.F Riley, Mathematical methods for physics and engineering, Cambridge, 2006
8. K.F Riley, M.P. Hobson, Mathematical methods for physics and engineering, student solution, Cambridge, 2006
9. K.T. Tang, Mathematical Methods for Engineers and Scientists, Springer series vol 1-3, 2006
10. H. Cohen: Mathematics for Scientists and Engineeers (Prentice-Hall, Englewood Cliffs 1992)

Director de Departament,
Prof.univ.dr. Alexandru JIPA

17.X.2017

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***Department of Structure of the Matter, Atmospheric and Earth Physics, Astrophysics***

## *Syllabus for the competition for Associate Professor, position 14*

***Department of Structure of the Matter, Atmospheric and Earth Physics, Astrophysics***

1. Introduction to the modeling and simulation of the physical phenomena. Elements of simulation and modeling in the condensed state physics. Types of simulations.
2. Problems regarding the computing system memory and running time. Free, constrained and periodic boundary conditions. Types of particle interaction potentials.
3. Computer simulations in condensed state physics. The principle of the method.
4. Simulations in various statistical ensembles: microcanonic, canonic, isothermal-isobar and grand-canonic.
5. Monte Carlo simulations of the macromolecular systems.
6. Simulation of the polymer crystallization processes.
7. Complex numbers. Applications.
8. Elements of differential calculus – differentiation, derivatives, partial derivatives.
9. Differential equations.
10. Vectorial spaces.

**References**

1. D. Frenkel, B. Smit, "Understanding Molecular Simulations. From Algorithm to Applications.", Academic Press, New York, 2002;
2. M.P. Allen, D.J. Tildesley, "Computer Simulation of Liquids", Oxford University Press, 1989;
3. D. P. Landau, K. Binder, "A Guide to Monte Carlo Simulations in Statistical Physics", Cambridge University Press, 2000;
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5. J.M. Coulson and J.F. Richardsson, Chemical Engineering, Vol. 1, Pergamon Press, 1990,appendix.
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