Institute of Solid Mechanics
Courses for SCOSAAR PhD students
2023-2024

Compulsory courses:

Course Name:	"***Introduction to the study of composite materials*** **"**
Course holder:	**Dr. Veturia Chiroiu, Institute of Solid Mechanics, Bucharest** **Dr. Ligia Munteanu, Institute of Solid Mechanics, Bucharest**
Course duration:	15 Hours
No credits:	15
Course structure:	1.Properties of composite materials. Reinforcement materials. 2.Continuous fibers. Staple fibers. Particles. 3.Matrices. Metal matrix composites. 4.Elasticity of composite materials. Anisotropic elasticity. 5.Continuous fiber reinforced composite materials. 6.Mechanical models. Built-in fiber model. 7.Micromechanical models for particle-reinforced composites. 8.Micromechanical models for discontinuous fiber composites. 9.Stresses and deformations in multilayer composite structures reinforced with fibers. Directions torequest. 10.Constitutive laws for composite materials. Homogenization procedures. Techniques of experimentalinvestigation of the state of tension and deformation. 11.Optimization of structures made of layered composite materials. Damage modeling. 12.Types of discontinuities, methodology for the study of structures with discontinuities made ofcomposites. 13.Fiber-reinforced multilayer composite tubes, non-prestressed tubes subjected to internal pressure.
Bibliography:	1. D. Gay, Materiaux composites, Editions Hermes, 1991. 2. S. Vlase, Elastodinamica elementelor finite. Editura Lux Libris, 1996; Mecanică computaţională, Editura Infomarket, 2006; Materiale composite. Metode de calcul. Editura Universităţii Transilvania, 2007. 3. N.D. Stănescu, L.Munteanu, V. Chiroiu, N.Pandrea, Sisteme dinamice. Teorie şi aplicaţii, vol. 1, 2, Editura Academiei, Bucureşti, 2007, 2011. 4. L. Munteanu, St. Donescu, Introduction to Soliton Theory: Applications to Mechanics, Book Series Fundamental Theories of Physics, 143, Kluwer Academic Publish., 2004. 5. M.Mihailescu, V.Chiroiu, Advanced mechanics on shells and intelligent structures, Editura Academiei, Bucureşti, 2004. 6. V.Chiroiu, P.Stiucă, L.Munteanu, St.Donescu, Introducere în nanomecanică, Editura Academiei, Bucureşti, 2005. 7. L.Munteanu, Nanocomposites, Editura Academiei, Bucureşti, 2012.

Course Name:	"***Elements of Mechanics, Mechatronics and Robotics***"
Course holder:	**Dr. Veturia Chiroiu, Institute of Solid Mechanics, Bucharest** **Dr. Ligia Munteanu, Institute of Solid Mechanics, Bucharest** **Dr. Luigi Vlădăreanu, Institute of Solid Mechanics, Bucharest**
Course duration:	15 Hours
No credits:	15
Course structure:	1. Kinematic elements 2. Dynamics and statics of the material point 3. Central forces. 4. Dynamics of material point systems 5. Dynamics and statics of the rigid solid 6. Robot kinematics: Position analysis 7. Dynamic analysis of robots 8. Trajectory planning 9. The intelligent control of the structures 10. The robustness of the control 11. Kinematic and dynamic control of a robot 12. Intelligent control techniques 13. Obstacle detection methods 14. Trajectory planning 15. Planning through potential fields
Bibliography:	1. C.Iacob, Mecanica teoretică, Editura Academiei, Bucureşti, 1972. 2. L.Dragoş, Principiile mecanicii analitice, Editura Tehnică, Bucureşti, 1976. 3. A. Carabineanum Necabica teoretică, Editura Matrix Rom, Bucureşti, 2006. 4. Bruno Siciliano, Oussama Khatib, Editors, Springer Handbook of Robotics, Editura Springer. 5. Spong M.W.,Vidyasagnar M., Robot Dynamics and Control, John Wiley&Sons, INC., New-York, 1989. 6. Fu K.S., Gonzalez R.C., Robotics: Control, Sensing, Vision and Intelligence, McGraw-Hill Book Company, Singapore, 1987. 7. Wolovich W.A., Robotics: Basic Analysis and Design, U.S.A., 1987. 8. Spong M.W., Lewis F., Abdallah C., Robot Control: Dynamics, Motion Planning and Analysis, IEEE Pres, 1992. 9. Bruno Siciliano, Oussama Khatib, Editors, Springer Handbook of Robotics, Editura Springer. 10. Peter Stone, Intelligent Autonomous Robotics, Editura Morgan & Claypool, 11. John J. Craig, Introduction to Robotics Mechanics and Control, Second Edition, Addison-Wesley Publishing Company. 12. Maria Letizia Corradini, Andreea Cristofaro, Fabio Giannoni, Giuseppe Orlando, Control Systems with Saturating inputs, Springer.

Course name:	"***Elements of Deformable Media Mechanics*** **"**
Course holders:	**Dr. Veturia Chiroiu, Institute of Solid Mechanics, Bucharest** **Dr. Ligia Munteanu, Institute of Solid Mechanics, Bucharest**
Course duration:	15 Hours
No. credits:	15
Course structure:	1. Stretch-compression experiments. The requirement of the continuously deformable medium. 2. Displacement status. The general theory of infinitesimal deformation. Geometric equations. 3. The deformation tensor. Deformation quadricles. Invariants. 4. External and internal forces. Tensions. Cauchy's relations. 5. Cauchy's equations. Reciprocity theorem. 6. The tension tensor. The tension squares. 7. Hooke's law. Hooke's tensor. Anisotropy. Orthotropy. Isotropy. 8. To Youmg's Mode. Poisson's ratio. Hydrostatic compression module. 9. Notions of thermodynamics of deformation. The principles of thermodynamics. 10. The elastic potential. The mechanical work of deformation. Elastic energy. Elastic bodies and hyperelastic bodies. 11. The complete system of equations of the theory of linear elasticity. 12. Resistance criteria. 13. Existence theorems. Uniqueness theorems. 14. Variational equations of elasto-statics. Reissner's variational equation. 15. The system of equations in displacements. The system of equations in stresses. 16. Where. Lamé's dynamic and static equations.
Bibliography:	1. L Solomon, Elasticitate liniară. Introducere matematică în statica solidului elastic, Editura Academiei, Bucureşti, 1969. 2. A.C. Eringen, Mechanics of Continua, Wiley&Sons, New York, 1967. 3. G.Thomas Mase, George E. Mase, Continuum mechanics for engineers, CRC Press, Boca Raton, 1999. 4. W. Nowacki, Dinamica sistemelor elastice, Editura Tehnică, Bucureşti, 1969. 5. S. Vlase, Mecanică. Cinematică, Editura Infomarket, Braşov, 2006; Mecanică. Dinamică, Editura Infomarket, Braşov, 2005; Mecanică. Statică, Editura Infomarket, Braşov, 2004.

Course name:	"***Technical mechanics and vibration*** **"**
Course holders:	**Dr. Veturia Chiroiu, Institute of Solid Mechanics, Bucharest** **Dr. Ligia Munteanu, Institute of Solid Mechanics, Bucharest**
Course duration:	15 Hours
No. credits:	15
Course structure:	1. Statics of material point and rigid solid.. Technical applications of statics. 2. Kinematics of the material point and the rigid solid. 3. Dynamics of material point systems. 4. Analytical mechanics. Lagrange's equations. 5. Rigid dynamics. 6. Kinematics of vibrations. Stability of movement. 7. Vibrations of linear systems with one degree of freedom. 8. Vibrations of linear systems with several degrees of freedom. Modal analysis. Friction systems. 9. Non-linear vibrations. 10. Vibrations of continuous systems. Types of depreciation. 11. Methods of measuring depreciation. Vibration control. 12. Parametric vibrations. 13. Hysteresis.
Bibliography:	1. Clarence W. de Silva, Vibration engineering, vibration: fundamentals and practice, CRC Press Boca Raton, 2000. 2. F. Dincă, C. Teodosiu, Vibraţii neliniare şi aleatoare, Editura Academiei, Bucureşti, 1959. 3. Gh.Buzdugan, M.Radeş, Vibraţiile sistemelor elastice, Editura Didactica si Pedagogica, 1978. 4. Cr. Pavel, Al.Constantinescu, Vibratii mecanice, Editura Matrixrom, Bucuresti, 2010. 5. C.M.Harris, C.E.Crede, Eds.. Shock and Vibration Handbook, McGraw-Hill Book Company, 1976. 6. R. Bishop, D. Johnson, The Mechanics of Vibration, Syndics of the Cambridge University Press, 1979. 7. N.D. Stănescu, L. Munteanu, V. Chiroiu, N. Pandrea, Sisteme dinamice. Teorie şi aplicaţii, vol.1, 2, Editura Academiei, Bucuresti, 2007, 2011. 8. A. Guran, F. Pfeiffer, K. Popp (eds.), Series on Stability, Vibration and Control of Systems, Series B, vol.7: Dynamics witg friction. Modeling, Analysis and Experiment, part I, World Scientific, 2001. .

Course name:	***„ Special chapters of mathematics ”***
Course holders:	**Prof. Dr. Luige Vladareanu** **Institute of Solid Mechanics, Bucharest**
Course duration:	36 Hours
No. credits:	30
Course structure:	1. General principles of special mathematics chapters. Matrix algebra. Matrix inversion, the Gauss-Jordan method, triangular matrices, linear and orthogonal transformations, the characteristic equation 2. Control elements of linear differential systems, controllability of linear systems. Systems of linear equations. Cramer's method/ Matrix/Inverse matrix/ Gauss/ Iterative of Jacobi/ Gauss-Seidel. 3. Optimal control, Pontriaghin's maximum principle 4. Dynamic programming equation, Hamilton-Jacobi-Bellman equation 5. Optimal time problem for linear systems, optimal control problem. The theorem of Rouche / Kronecker-Capelli / Homogeneous systems 6. The geometric form of Pontriaghin's maximum principle 7. Optimal control with final free time. Approximation of functions by interpolation. Lagrange / Newton interpolation polynomial 8. Maximum principles for optimal control problems. Criteria for approximation of functions. The criterion of approximation by interpolation / with minimum mean square deviation / approximation in the sense of Cebâşev. 9. The connection between the maximum principle and the principle of dynamic programming 10. Examples of optimal control problems. Taylor / Runge-Kutta series development method / Predictor-corrector methods / Picard. Ordinary differential equations with one parameter 11. Applications. Architecture of real-time control systems in decentralized and distributed structure. Advanced techniques for real-time control of mechatronic systems. Real-time control of multiple processes in distributed and decentralized structures. The tree structure of the dynamic menu with intelligent terminals.
Bibliography:	1. Leonte A., Vraciu G., Elemente de calcul matriceal cu aplicaţii, Editura Tehnică, Bucureşti. 2. Bellman R., Introducere în analiza matriceală, Editura Tehnică, Bucureşti. 3. Mihu C., Metode numerice în algebra liniară, Editura Tehnică, Bucureşti. 4. Larionescu D., Calcul numeric pentru ingineri, Editura AGIR, Bucureşti. 5. Carnahan B., Luther H.A., Wilkes J.O., Apllied Numerical Methods, John Wiley & Sons, Inc., New York. 6. Pao Y.C., Engineering Analysis. Interactive Methods and

Programs, CRC Press.

7. Vladareanu, Luige - "Achizitia numerica a datelor fizice experimentale in sisteme multimicroprocesor" – Ed. Tehnica, Colectia "Universitaria", ISBN 973-31-2144-4, pp.232.
8. B. Roffel, B.H.L. Betlem, Advanced Practical Process Control, 309 pag, Editura Springer, ISBN 3-540-40480-5.
9. V. Damic, J. Montgomery, Mechatronics by Bond Graphs, 448 pag, Editura Springer, ISBN 3-540-42375-3
10. Salvatore Pennacchio, Editor, International Society for Advanced Research, Emerging Technologies, Robotics and Control Systems Volume 1, Universita degli Studi Palermo, Italy, ISBN: 978-88-901928-1-4.
11. Theodor Borangiu, Advanced Robot Motion Control, Editura AGIR, Editura Academiei Române, ISBN 973-8130-98-0 (Editura AGIR), ISBN 973-27-0976-6 (Editura Academiei Române).
12. Torsten Kröger and Friedrich M. Wahl (Eds.), Advances in Robotics Research Theory, Implementation, Application, Springer Verlag.
13. Vincent Duindam, Stefano Stramigioli, Modeling and Control for Efficient Bipedal Walking Robots, 211 pag, Editura Springer, ISBN 978-3-540-89917-4, e-ISBN 978-3-540-89917-1.
14. Luige Vladareanu, Controlul în timp real cu automate programabile în mecanica solidelor, 206 pag, Editura Bren, ISBN 973-648-431-0, ISBN 973-648-431-7.
15. Venturia Chiroiu, Tudor Sireteanu, Topics in Applied Mechanics, 509 pag, Editura Academiei Române, ISBN 973-27-1245-7, ISBN 973-27-1004-7.
16. Miomir Vukobratovic, Vejko Potkonjak, Vladimir Matijevic, Microprocessor-based and intelligent systems engineering, 246 pag., Editura Kluwer Academic, ISBN 1-4020-1809-6.

Course name:	***„Real-time modeling, simulation and control of mechatronic systems”***
Course holders:	**Prof. Dr. Luige Vladareanu - Institute of Solid Mechanics, Bucharest**
Course duration:	36 Hours
No. credits:	30
Course structure:	1. General general principles of modeling, simulation and real-time control of mechanical systems. 2. Advanced process control concepts, domain transformations, Laplace transform, discrete approximations, z transform, Dahlin control algorithm, constrained optimal multivariable control. 3. Concepts of theory, probabilities, random variables, continuous random variables, joint probability distributions, data selection, hypothesis tests 4. Modeling and identification of mechanical processes, linear and non-linear models, dynamic and static models, discrete models and continue, identifying parametric and non-parametric models 5. Statistical data exploration, simple regression and correlation, multiple regression and correlation 6. Modeling and simulation in mechatronics, the basic concepts and methods of object-oriented modeling, generation of model equations and solutions. 7. Simulation of mechanical systems. Simulation using Matlab/COMSOL. Simulation using Lab-View. Simulation with PLC systems. 8. Modeling and simulation in mechatronics by using BOND graphs. Applications of Bond graphs in modeling the movement of an anthropomorphic robot. 9. Design of uni-factorial experiments, design of multi-factorial experiments, statistical control. 10. Applications of modeling, simulation and real-time control of vector-oriented mechanical systems of terrestrial, aerial, aquatic robots.
Bibliography:	1. Bruno Siciliano, Luigi Villani, Robot Force Control, 144 pag, Editura Kluwer Academic, ISBN 0-7923-7733-8. 2. V. Damic, J. Montgomery, Mechatronics by Bond Graphs, 448 pag, Editura Springer, ISBN 3-540-42375-3. 3. B. Roffel, B.H.L. Betlem, Advanced Practical Process Control, 309 pag, Editura Springer, ISBN 3-540-40480-5. 4. Salvatore Pennacchio, Editor, International Society for Advanced Research, Emerging Technologies, Robotics and Control Systems Volume 1, Universita degli Studi Palermo, Italy, ISBN: 978-88-901928-1-4. 5. Theodor Borangiu, Advanced Robot Motion Control, Editura AGIR, Editura Academiei Române, ISBN 973-8130-98-0

(Editura AGIR), ISBN 973-27-0976-6 (Editura Academiei Române).
6. Dan Ştefanoiu, Theodor Boragiu, Florin Ionescu, Robot Modelling and Simulation, Editura AGIR, Editura Academiei Romane, ISBN 973-8466-74-1 (Editura AGIR), ISBN 973-27-1082-9 (Editura Academiei Române).
7. Torsten Kröger and Friedrich M. Wahl (Eds.), Advances in Robotics Research Theory, Implementation, Application, Springer Verlag.
8. Vincent Duindam, Stefano Stramigioli, Modeling and Control for Efficient Bipedal Walking Robots, 211 pag, Editura Springer, ISBN 978-3-540-89917-4, e-ISBN 978-3-540-89917-1.
9. Vladareanu, Luige, Controlul în timp real cu automate programabile în mecanica solidelor, 206 pag, Editura Bren, 2005, ISBN 973-648-431-0, ISBN 973-648-431-7.
10. Vladareanu, Luige, "Achizitia numerica a datelor fizice experimentale in sisteme multimicroprocesor" – Ed. Tehnica Colectia "Universitaria", ISBN 973-31-2144-4, pp.232
11. Theodor Borangiu, Michel Dupas , Robot–Vision Mise en oeuvre en V+, Editura AGIR, Editura Academiei Române, ISBN 973-8130-64-6 (Editura AGIR), ISBN 973-27-0850-6 (Editura Academiei Române).
12. Venturia Chiroiu, Tudor Sireteanu, Topics in Applied Mechanics, 509 pag, Editura Academiei Române, ISBN 973-27-1245-7, ISBN 973-27-1004-7.
13. Salvatore Pennacchio, Editor, International Society for Advanced Research, Emerging Technologies, Robotics and Control Systems Volume 1, Universita degli Studi Palermo, Italy, ISBN: 978-88-901928-1-4
14. Dumitru Ion, E. Diatcu, Roboţi Mobili şi Vehicule Ghidate Automat, Editura Victor, ISBN973-9226-03-7.
15. Miomir Vukobratovic, Vejko Potkonjak, Vladimir Matijevic , Microprocessor-based and intelligent systems engineering, 246 pag., Editura Kluwer Academic, ISBN 1-4020-1809-6.

Course name:	***„Kinematics and robot dynamics”***
Course holders:	**Prof. Dr. Luige Vladareanu - Institutul de Mecanica Solidelor, Bucureşti**
Course duration:	36 ore
No. credits:	30
Course structure:	1. General principles of robot kinematics and dynamics. Denavit-Hartenberg (D-H) coordinate transformation. Inverse kinematics. Kinematics of movement: plane, three-dimensional cases, spherical joint. 2. The principles of robot dynamics modeling. The method of block matrices. The method of N-E equations. The Euler angle method. 3. Motion kinematics and robot trajectory planning. Polynomial trajectories and cubic segments. Linear segments with parabolic connections. Coordinating the movements of a robot's axes. 4. Fundamentals of monitoring and control of mechatronic systems equipped with artificial vision - concepts, development, modeling. 5. Modeling and identification of mechatronic processes. Methods based on Lagrange's equations. 6. Image modeling and processing 7. Representation of images and their properties, segmentation of images and representation of shapes 8. Modeling and recognition of objects 9. Modeling and simulation in motion control. Methods based on Gauss' principle and Appel's equations. 10. Simulation of tracking methods 11. Simulation of automatic movement control using visual information (visual servoing), three-dimensional vision and movement analysis 12. Modeling and simulation in positioning control
Bibliography:	1. Wolovich W.A., Robotics: Basic Analysis and Design, U.S.A. 2. Paul R.P., Robot manipulators: Mathematics, programming and control, The Massachusetts Institute of Technology, U.S.A. 3. Bruno Siciliano, Oussama Khatib, Editors, Springer Handbook of Robotics, 1611 pag., Editura Springer, ISBN 978-3-540-23957-4. 4. Ránki P.G., Ho C. Y., Robot modelling. Control and Applications with software, Springer Varlag, Berlin, Heidelberg-New York-Tokyo. 5. Fu K.S., Gonzalez R.C., Robotics: Control, Sensing, Vision and Intelligence, McGraw-Hill Book Company, Singapore. 6. Wolovich W.A., Robotics: Basic Analysis and Design, U.S.A. 7. Vukobratović M., Potkonjak V., Dynamics of Manipulation Robots, Springer-Verlog Berlin Heidelberg New York. 8. Spong M.W., Lewis F., Abdallah C., Robot Control: Dynamics,

Motion Planning and Analysis, IEEE Pres.

9. Spong M.W., Vidyasagnar M., Robot Dynamics and Control, John Wiley&Sons, INC., New-York.
10. Natale, C., Interaction Control of Robot Manipulators, Springer, Berlin Heidelberg New York.
11. Neagoe Mircea, Cinematica roboţilor industriali.*Precizia roboţilor, Editura Universităţii „Transilvania" din Braşov, ISBN 973-635-020-7.
12. Ránki P.G., Ho C. Y., Robot modelling. Control and Applications with software, Springer Varlag, Berlin, Heidelberg-New York-Tokyo.
13. Fu K.S., Gonzalez R.C., Robotics: Control, Sensing, Vision and Intelligence, McGraw-Hill Book Company, Singapore.
14. Mihael Chircor, Adrian Curaj, Elemente de Cinematica, Dinamica şi Planificarea Traiectoriilor Roboţilor Industriali, Editura Academiei Române, ISBN 973-27-0850-6.
15. Ionel Stareţu, Mircea Neagoe, Niculai Albu, Mâini Mecanice, Editura Lux Liberis, ISBN 973-9428-27-4.
16. Dorel Aiordachioaie, Aspects of Robot Driving, Editura Matrix Rom Bucureşti, ISBN 973-685-694-1.
17. Zivanovic and Vukobratovic, Multi-Arm Cooperating Robots - Dynamics and Control - - allbooksfree.tk.rar.

Course name:	***Compound rheological models***
Course holders:	**Prof. Univ. Dr.Ing. Polidor Bratu – Institute of Solid Mechanics**
Course duration:	44 Hours
No. credits:	30
Course structure:	1. Linear rheological models composed of mass subjected to external kinematic actions 2. Linear rheological models composed without mass subjected to external dynamic actions 3. Linear rheological models composed with mass subjected to external kinematic actions 4. Linear rheological models composed with mass subjected to external dynamic actions 5. The dynamic behavior of the rigid with Voigt-Kelvin, Maxwell and Zener rheological links 6. Dynamic behavior of the rigid with Hooke-Voigt-Kelvin, Maxwell-Voigt-Kelvin and Newton-Voigt-Kelvin rheological links 7. Dynamic analysis with compound rheological links to imposed harmonic excitations 8. Establishing the optional parameters for the forces transmitted to the base and for the dissipated energy 9. Variation curves of the kinematic or dynamic transmissibility coefficient Calculation and optimization algorithms for dynamic isolation at a predictable level.
Bibliography:	1. Bratu, P. Vibratiile sistemelor mecanice, Ed. Tehnica, 2000 2. Bratu, P. Analiza structurilor elastice, Ed. Impuls, 2010 3. Pavel,C, Constantinescu A, Vibratii mecanice, Ed.Matrixrom, 2010 4. Harris, C;Crede, C, Share and Vibration Handbook, Ed.McGraw- HillBook Comp.,1976 5. Stanescu, D, Muneteanu, L, Chiroiu, V, Pandrea, N, N. Sisteme dinamice,Vol.1,2, Ed.Academiei 2007, 2011

Course name:	***Dynamic isolation at the base of structures at seismic actions***
Course holders:	**Prof. Univ. Dr.Ing. Polidor Bratu – Institute of Solid Mechanics**
Course duration:	44 Hours
No. credits:	30
Course structure:	1. The spectral composition of seismic signals. 2. The structural conformation of buildings founded directly in the ground. 3. Destructive effects as a result of the transmission of seismic actions on the structural composition. 4. Methods of reducing the effects of earthquakes by isolating the base of the building. 5. Mechanical models of dynamic insulation in buildings. 6. Mechanical models for dynamic isolation of bridges and viaducts. 7. Anti-seismic systems and devices for isolation at the base. 8. Physical-mechanical characteristics of anti-seismic isolation devices. 9. Dynamic models with compound rheological links. 10. Analysis of optimization dynamics.
Bibliography:	1. Bratu, P. Sisteme elastice de rezemare pentru masini si utilaje, Ed.Tehnica, 1990 2. Bratu, P. Analiza sistemelor elastice, Ed. Impuls, 2010 3. Ene, GH.Pavel, C, Introducere in tehnica izolarii vibratiilor si azgomotului, Ed. Matrixrom, 2012 4. Randall, R. Application of BkEquipment to freqvency analyisis, Bruel &Kjaer, Naerum, Denmark, 1977 5. Sireteanu, T. Chiroiu, V.Topics in Applied Mechanics, Ed. Academieie,2009

Course name:	***Methods for solving ordinary differential equations***
Course holders:	**Prof. univ. dr.mat, hab. Nicolae Pop – Institute of Solid Mechanics**
Course duration:	36 Hours
No. credits:	30
Course structure:	1. One-step approximation methods 2. Euler's method. The modified Euler method and the Heun method 3. Multistep approximation methods, order of convergence, order of consistency and stability 4. Particular multistep methods: Adams method, Adams-Bashfort method, Adams-Multon method, Nyström method and Milne-Simpson method 5. Picard's method of successive approximations 6. The Runge-Kutta method 7. Disturbance method 8. Mediation method 9. The method of non-autonomous dynamic systems. The Van der Pol plan 10. Stability of periodic solutions of nonlinear dynamic systems.
Bibliography:	1. Verhulst, F., *Nonlinear Differential Equations and Dynamical Systems*,1990, Springer-Verlag, Berlin, Heidelberg, New York, London, Paris, Tokyo, Hong Kong. 2. Pavaloiu, I., Pop, N., *Interpolare si aplicatii*, Editura Risiprint, Cluj-Napoca, 2005 3. Pavaloiu, I., Pop, N., *Interpolation and Applications*, Lambert AcademicPublishing, Printed by Schaltungsdienst Lange o.H.G., Berlin, 2017 4. Voinea, R.,Stroe, I., *Introducere in teoria sistemelor dinamice*, EdituraAcademiei Romane, Bucuresti, 2000 *5.* Stanescu, D, Muneteanu, L, Chiroiu, V, Pandrea, N, N. *Sisteme dinamice*, Vol.1,2, Ed.Academiei 2007, 2011 6. Lefter, C-G., *Ecuatii diferentiale si sisteme dinamice*, Editura AlexandruMyller, Iasi, 2006

Course name:	***Control of systems of differential equations***
Course holders:	**Prof. univ. dr.mat, hab. Nicolae Pop – Institute of Solid Mechanics**
Course duration:	36 Hours
No. credits:	30
Course structure:	1. Control of linear differential systems 2. Controllability of linear systems, optimal control, Pontriaghin's maximum principle 3. The dynamic programming equation or the Hamilton-Jacobi-Bellman equation 4. The quadratic linear regulator and the optimal time problem for linear systems 5. Accessible crowds and optimal control problem 6. The geometric form of Pontriaghin's maximum principle 7. The optimal control problem with final free time 8. The maximum principle for optimal control problems 9. The connection between the maximum principle and the principle of dynamic programming 10. Examples of optimal control problem.
Bibliography:	1. Arnold, V.I., *Mathematical methods of classical mechanics*, vol.60,Graduate Texts in Mathematics. Springer-Verlag, New-York, 1978. 2. Barbu, V., *Metode matematice in optimizarea sistemelor diferentiale*,Editura Academiei, Bucuresti, 1989 3. Barbu, V., Lefter, C., *Optimal control of ordinary differential equation*s, Canada, A. (ed.) et al., Ordinary differential equations, Vol.II, Amsterdam, Elsevier/North Holland, Handbook of Differential Equations,1-75, 2005 4. Bellman, R., *Dynamic programming*, Princeton University Press,Princeton, N.J., 1957 5. Lefter, C-G., *Calculul variatiilor si controlul sistemelor diferentiale*,Editura Alexandru Myller, Iasi, 2006 6. Mitu, A-M., Popescu, I., Sireteanu, T., *Comportarea dinamica a sistemelor cu caracteristici de tip hysteretic*, MATRIXROM, bucuresti,2012 7. Pontriaghin, L., Boltianski, V., Gamkrelidze, R., Michtchenco, E., *Theorie mathematique des processus optimaux*, Editions Mir, Moscow,1974 8. Vrabie, I.I., *Ecuatii diferentiale*, Editura MATRIXROM, Bucuresti, 2000 9. Zabczyk, J., *Mathematical control theory: an introduction*. Systems&Control: Foundations&Applications, Birkhäuser Boston Inc.,Boston, MA, 1992

Course name:	***Computer design using Matlab and Finite Element programs***
Course holders:	**Prof. univ. dr.mat, hab. Nicolae Pop – Institute of Solid Mechanics**
Course duration:	36 Hours
No. credits:	30
Course structure:	1. Principles of computer design using MATLAB software. 2. Using MATLAB software through examples. 2.1 Modeling optimal control problems; 2.2 LQR, linear quadratic regulator; examples of problems with Bang Bang control; 2.3 Coulomb friction problems. 3. Optimization problems with restrictions, tracking and controlling the trajectory of the "end-effectors" of manipulator robots with two links. 4. The principles of modeling with the finite element method (FEM). 4.1 The use of MEF in 1D with bars, in 2D with triangular or quadrilateral plates, as well as thin plates and in 3D with the finite element with 8 nodes, 5. The use of finite element software for static analysis of structures (displacements and stresses) and for dynamic analysis: frequencies and modes of vibration.
Bibliography:	1. Amar Khennane, Introduction to Finite Element Analysis Using MATLAB and Abaqus, 2013 by Taylor & Francis Group, LLC, CRCPress is an imprint of Taylor & Francis Group, an Informa business. 2. Stormy Attaway, MATLAB. A practical Introduction to Programmingand Problem Solving (Fourth Edition), Elsevier, Amsterdam, 2017. 3. Tobin A. Driscoll, LearningMATLAB, Society for Industrial and AppliedMathematics (SIAM), 2009. 4. Amos Gilat,MATLABR . An Introduction with Applications (Fifth Edition),Wiley, 2015. 5. Duane Hanselman, Bruce Littlefield, Mastering MATLAB, Pearson, 2012. 6. Rudra Patrap, Getting Started with MATLAB. A Quick Introduction forScientists and Engineers, Oxford University Press, 2010. 7. Bathe, K.-J.: Finite-Elemente-Methoden. Berlin, Heidelberg,New York: Springer1986 • Zienkiewicz, O.C.: The Finite Element Method. McGraw-Hill 1977. 8. Huebner, H. K. : The Finite Element Method for Engineers John Willey & Sons1975. 9. Blumenfeld, M Introducere in metoda elementelor finite Ed. Tehnica, 1995. 10. Garbea , D. Analiza cu elemente finite Ed. Tehnica, 1990. 11. Pascariu, I. Elemente finite Concepte-Aplicatii Ed. Militara , 1985. 12. Zienkiewicz, O.C.: The Finite Element Method. McGraw-Hill 1977. 13. Huebner, H. K. : The Finite Element Method for Engineers John Willey & Sons1975.

Course name:	***Applied Statistics in Engineering***
Course holders:	**CS I dr. eng. habil. Mihaiela ILIESCU – Institute of Solid Mechanics**
Course duration:	52 Hours
No. credits:	30
Course structure:	1. Basic notions of probability theory 2 Discrete random variables 3. Continuous random variables 4. Joint probability distributions 5. Data selection 6. Hypothesis tests 7. Exploring statistical data 8. Simple regression and correlation 9. Multiple regression and correlation 10. Design of uni-factorial experiments 11. Designing multi-factorial experiments 12. Statistical quality control. 13. Software for applied statistics in engineering
Bibliography:	1. Chambers J., Cleveland W., Kleiner B., Tukey F., *Graphical Methods for DataAnalysis*, Wadsworth &Brooks/Cole, Pacific Grove, CA, 1983. 2. Douglas C. Montgomery, Goerge C. Runger, *Applied Statistics andProbability for Engineers*, John Wiley & Sons, Inc., USA, 2003. 3. Duncan A. J., *Quality Control and Industrial Statistics*, 5th edition, Richard D.Irwin, Homewood, Illinois, 1986. 4. Hines W. W., Montgomery D. C., *Probability and Statistics in Engineeringand Management Sciences*, John Wiley & Sons, Inc., USA, 2003. 5. Militaru, C., Iliescu M, *Statistică aplicată în inginerie şi economie*, EdituraBren, Bucureşti, ISBN 943-648-561-7, 2006. 5. Milton, J.S., Arnold, J.C., *Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences*, McGraw-Hill, 1990. 6. Montogomery D. C., *Introduction to Statistical Quality Control*, 4th edition, John Wiley & Sons, Inc., USA, 2001. 7. *NIST/SEMATECH e-Handbook of Statistical Methods*, 2006 http://www.itl.nist.gov/div898/handbook/, date. *8.* Stephen R. Schmidt, Robert G. Launsby, *Understanding Industrial designed experiments*, Air Academy Press, Colorado, ISBN 1-880156-03-2, 2005

Course name:	***Manufacturing Technologies for Mechanical Components of Industrial robots***
Course holders:	**CS I dr. eng. habil. Mihaiela ILIESCU – Institute of Solid Mechanics**
Course duration:	52 Hours
No. credits:	30
Course structure:	1. The basics of manufacturing technologies of mechanical components of industrial robots 2 Designing technological processes for the manufacture of mechanical components of industrial robots 3. Fundamental elements of processing on CNC machine tools 4. Manufacturing technologies on lathes and machining centers with CNC turning 5. Manufacturing technologies on vertical / horizontal CNC machining centers 6. Manufacturing technologies on CNC grinding centers 7. Manufacturing technologies on CNC toothing machines 8. Manufacturing technologies by cold plastic deformation 9. Manufacturing technologies through rapid prototyping (Rapid Prototyping) 10. Reverse Engineering 11. Industry 4.0
Bibliography:	1. Neagu C., Iliescu V., Iliescu M., Purcărea M., "Tehnologia construcţiei de maşini – Bazele teoretice", ISBN 973-685-504-X, Editura MATRIX ROM, Bucureşti, 2002 2. Tache V., ş.a., "Proiectarea dispozitivelor pentru maşini-unelte", Editura Tehnică, Bucureşti, 1979 3. Popescu I., Vlase A., ş.a., "Tehnologia fabricării produselor mecanice, vol. I", ISBN 973-685-495-7, Editura MATRIX ROM, Bucureşti, 2005 4. Vlase A., ş.a., "Tehnologia construcţiilor de maşini", Editura Tehnică,Bucureşti, 1996 5. M. Piska, M. Hill, P. Cihlarova, "Fundamentals of CNC Machining", BrnoUniversity of Technology, Institute of Manufacturing Technology, 2008 6. Ciocârdia C., ş.a., "Tehnologia presării la rece", Editura didactică şipedagogică, Bucureşti, 1991 7. N. Hopkins, R.J.M. Hague, P.M. Dickens, "Rapid Manufacturing – anIndustrial Revolution for the Digital Age", John Wiley & Sons Inc, West Sussex, 2006

Course name:	***Analysis and simulation of mobile mechanical systems***
Course holders:	**CS I dr. eng. habil. Mihaiela ILIESCU – Institute of Solid Mechanics**
Course duration:	52 Hours
No. credits:	30
Course structure:	1. 1. Positional-kinematic modeling of some modular groups 2. 2. Mobile mechanical systems. Biomechanical systems 3. 3. Strategies and models of movement of mobile mechanical systems 4. 4. Kinematic modeling of mobile mechanical systems 5. 5. Dynamic modeling of mobile mechanical systems 6. 6. Balancing of mechanical systems 7. 7. Concepts, algorithms and methods for modeling and simulating mechanical systems 8. 8. Modeling and simulation of mobile mechanical systems 9. 9. Command and control of mobile mechanical systems 10. 10. Mechatronic systems 11. 11. Case studies – mobile mechanical systems; mechatronic systems; biomechanical systems
Bibliography:	1. Comănescu, Adr., Comănescu, D., Dugăeşescu, I., Boureci, A., Bazele modelării mecanismelor, Editura Politehnica Press, Bucureşti, 2010, ISBN 978-606-515-115-4, 274 pag.; 2. Comănescu, Adr., Comănescu, D., Georgescu, L., Bazele analizei şi sintezei mecanismelor cu memorie rigidă, Editura Politehnica Press, Bucureşti, 2008, 180 pag.; 3. Comănescu, Adr., Programe de modelare, simulare si animatie a mecanismelor si robotilor, UPB, 1998-2007; 4. *** Robotics and Autonomous Systems, 1992-2000; 5. Anderson, R.J., Building a modular robot control system using passivity and scattering theory, in: Proc. IEEE Int. Conf. Robotics and Automation,1996, pp. 698–705; 6. Warnaar, D.B., M. Chew, Kinematic synthesis of deployable–foldable truss structures using graph theory—Part 1: Graph generation. J. Mech. Des. 117, 1995, pp. 112–116; 7. Warnaar, D.B., M. Chew, Kinematic synthesis of deployable–foldable truss structures using graph theory—Part 2: Generation of deployabletruss module design concepts. J. Mech. Des. 117,1995, pp. 117–121;

Course name:	***Research Project Management***
Course holders:	**CS I dr. eng. habil. Victor Vlădăreanu – Institute of Solid Mechanics**
Course duration:	28 Hours
No. credits:	10
Course structure:	1. Fundamentals of project management 1.1. Content management 1.2. Time management 1.3. Financial and procurement management 1.4. Human resources management 1.5. Communication management 1.6. Quality management 1.7. Risk management 1.8. Applied notions of risk estimation, planning and management 2. Project management in Engineering Sciences 2.1. Life cycle of engineering projects – traditional and modern methods 2.2. Time and human resource management for engineering projects 2.3. Financial management for engineering projects 2.4. Quality management for engineering projects 3. Integration of projects in the organizational framework 3.1. Integration management and project portfolios 3.2. Project development management
Bibliography:	1. Ian Sommerville, Software Engineering, Editia a 9-a, Addison- Wesley, 2011 2. A Guide to the Project Management Body of Knowledge (PMBOK® Guide)—Fifth Edition, 2013, ISBN-13: 9781935589679 3. Ioan Stefan Sacala, Mihnea Alexandru Moisescu, "Management de proiect pentru dezvoltarea sistemelor informaționale" – ISBN 978- 606-23-0325-9, Editura Printech 2014 4. Thommen, J. P., & Grösser, S. (2014). Economy, Company, Management: Introduction to Business Administration. Versus Verlag.

Optional course:

Course name:	**"*Introduction to vibration control* "**
Course holders:	**Dr. hab. Ligia Munteanu, Institute of Solid Mechanics, Bucharest** **Dr. Veturia Chiroiu, Institute of Solid Mechanics, Bucharest**
Course duration:	72 Hours
No. credits:	30
Course structure:	1.Fundamentals of vibration theory analyzed from practical perspectives 2.Overview of damping mechanisms 3.Measurement of damping. 4. The dynamic behavior of plastic and elastomeric materials 5. Dynamic behavior of viscoelastic materials 6. Dynamic behavior of smart materials 7. Vibration isolation. Transmissibility. Dynamic absorbers 8. Misconceptions regarding damping 9. Vibration control 10. Passive, active, semi-active vibration control methods 11. Examples
Bibliography:	1. Buzdugan Gh., Măsurarea vibraţiilor, Ed. Academiei, Bucureşti, 1983. 2. Darabont A., Măsurarea zgomotului şi vibraţiilor în tehnică, Ed. Tehnică, Bucureşti, 1983. 3. Philips A.V., Vibration and noise in motor vehicles, Institution of Mechanical Engineers, 1972. 4. Randall R.B., Application of B&K Equipment to frequency analysis, Bruel & Kjaer, Naerum, Danemarca, 1977. 5. Gh. Ene, C. Pavel, Introducere in tehnica izolarii vibratiilor si a zgommotului, Marix Rom, 2012. 6. Grumăzescu M., Stan A., Wegener N., Marinescu V., Combaterea zgomotului şi vibraţiilor, Editura Tehnică, Bucureşti, 1966. 7. Darabont A., Măsurarea zgomotului şi vibraţiilor în tehnică, Editura Tehnică, Bucureşti, 1983. 8. N.D. Stănescu, L.Munteanu, V. Chiroiu, N.Pandrea, Sisteme dinamice. Teorie şi aplicaţii, vol. 1, 2, Editura Academiei, Bucureşti, 2007, 2011. 9. M.Mihailescu, V.Chiroiu, Advanced mechanics on shells and intelligent structures, Editura Academiei, Bucureşti, 2004. 10. V.Chiroiu, P.Stiucă, L.Munteanu, St.Donescu, Introducere în nanomecanică, Editura Academiei, Bucureşti, 2005. 11. Enescu N., Acustică Tehnică, Universitatea Politehnica Bucureşti, 1997.

SD-SIMC directory,

Dr.ind. habil. Mihaiela ILIESCU

Secretary,

dr. Marilena Cristina NIȚU