Course Information Sheet

University: *University of Prešov in Prešov*	
Faculty: *Faculty of Humanities and Natural Sciences*	
Code: *2FYZ/mTMECH/22*	**Title of Course:** *THEORETICAL MECHANICS*
Form of Study: *Lectures, seminars* **Number of contact hours:** *39* **per week:** *2/1* **per level/semester:**	
Number of credits: *4*	
Semester: *summer*	
Degree/Level: *1. level*	
Prerequisities: *The general course of Physics.*	
Grading Policy (Assessment/Evaluation): *Continuous – written test (10 %), final – oral exam (30 %), exam (60%)* *A= min. 90%, B= min. 80%, C= min. 70%, D= min. 60%, E= min. 50%, FX < 50%*	
Aims and Objectives: *The aim of the lecture is to master the basics of the analytical theory of theoretical mechanics.*	
Syllabus/Indicative Content:	

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1. Introduction, basic mathematics.
2. Basic of particle kinematics – velocity, acceleration, areal velocity, areal acceleration, angular velocity angular acceleration.
3. Curved coordinate systems, kinematics of relative motion.
4. Basic terminology of dynamics of particles system - Newton´s laws of motion.
5. Law of momentum conservation of free particle, law of angular momentum conservation of free particle.
6. Kinetic energy of particle and power of force. Work of force.
7. Conservative force field.
8. Potential energy of particle.
9. Law of mechanical energy conservation of the free particle.
10. Conservative force as gradient of potential energy.
11. Potential of conservative force field.
12. Motion equations of free particles system.
13. First equation of motion and law of momentum conservation of particles system.
14. Second equation of motion and law of momentum conservation of particles system.
15. Kinetic energy of free particles system.
16. Potential energy of free particles system.
17. Dynamics of relative motion.
18. Galilei transformations.
19. Constraints and their classification. Configuration space.
20. Principle of virtual works. Balance conditions.
21. D`Alembert's and Lagrange principle.
22. Lagrange equations of the first kind.
23. Generalized coordinates, generalized forces, potential generalized forces.
24. Deduction of Lagrange equations of the second kind.
25. Legendre transformation.
26. Hamilton's equations, Hamilton function properties.
27. Basic of variation calculation. Hamilton principle.
28. Evidence of Hamilton principle and D`Alambert's principle equivalence.
29. Deduction of Hamilton equations from Hamilton principle.
30. Time-space symmetries and laws of conservation.
31. Integral principles - energy integral, momentum integral, angular momentum integral.
32. Introduction to rigid body dynamics.
33. Euler kinematics equations.
34. Tensor of inertia and kinetic energy of solid body.
35. Euler dynamic equations.

36. *Gyroscopes.*
37. *Subject matter and methods of continuum mechanics study.*
38. *Volume force, arial force, vector a tensor of tension.*
39. *Continuum balance conditions.*
40. *Continuity equation and continuum motion equations.*
41. *Fluid mechanics.*

Suggested readings:

1. Dreizler, Reiner, M., Lüdde, Cora, S. 2010. *Theoretical Mechanics*. Springer. ISBN 978-3-642-11137-2
2. Obetková, V., Mamrillová, A., Košinárová, A. 1990. *Teoretická mechanika*. Bratislava: Alfa.
3. Staržinskij, V. M. 1980. *Teoretičeskaja mechanika*. Moskva: Nauka.
4. Tóth, Ľ., Tóthová, M. 1985. *Teoretická mechanika I., II*. Košice. Učebné texty.

Language of Instruction: *English*

Other course information:

Lecturer/Instructor: *prof. RNDr. Marián Reiffers, DrSc.*

Last update: *3. mája 2024*

Approved by: *Dr. h. c. doc. PaedDr. Vladimír Šebeň, PhD.*