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| **Course code** | CC1 |
| **Type and description** | CC - core curriculum for mechanical engineering discipline |
| **ECTS credit** | 1 |
| **Course name** | **Mathematical methods of mechanics** |
| **Course name in Polish** | **Matematyczne metody mechaniki** |
| **Language of instruction** | English |
| **Course level** | 8 PRK |
| **Course coordinator** | **prof. dr hab. inż. Jan Awrejcewicz** |
| **Course instructors** | **dr. hab. inż. Grzegorz Kudra, prof. PŁ** |
| **Delivery methods and course duration** | |  | **Lecture** | **Tutorials** | **Laboratory** | **Project** | **Seminar** | **Other** | **Total of teaching hours during semester** | | --- | --- | --- | --- | --- | --- | --- | --- | | Contact hours | 20 |  |  |  |  | 0 | 20 | | E-learning | No | No | No | No | No | No |  | | Assessment criteria (weightage) | 1,00 |  |  |  |  | 0,00 | 1,00 | |
| **Course objective** | 1. To enable students to acquire knowledge in the field of mathematical methods of vibration analysis of mechanical systems  2. To enable students to acquire knowledge in the field of mathematical methods of modelling mechanical systems |
| **Learning outcomes** | After the course the PhD student can:  1. characterize and present by examples the selected problems of parametric vibrations occurring in mechanical systems – outcome W1.  2. characterize and present by examples the selected concepts and methods of mathematical analysis of dynamical systems (phase space, singular points, perturbation methods) – outcome W1  3. characterize and present by examples the selected methods of mathematical modelling of mechanical systems (dynamics in generalized coordinates, governing equations of motion of a rigid body about a fixed point) – outcome W1 |
| **Assessment methods** | Outcomes 1- 3 - written test  Final grade consists of:  result of written test - 100% |
| **Prerequisites** | 1. Knowledge in the field of linear algebra and mathematical analysis, integral and differential calculus, basics of analytical geometry, basics of statistics, basics of matrix algebra.  2. Systematic and theoretically founded general knowledge of mechanics of material systems. |
| **Course content with delivery methods** | LECTURE  1. Linear differential equations with periodic coefficients. Hill’s equation. Meissner’s and Mathieu’s equations.  2. Phase plane and phase space. Singular points.  3. Perturbation methods. Autonomous systems: the Krylov and Krylov-Bogolubov-Mitropolskiy method. Non-autonomous systems: oscillations near and away from resonance.  4. Dynamics in generalized coordinates. Lagrange’s equations.  5. Rigid body motion about a fixed point. The Euler-Poinsot equations. |
| **Basic reference materials** | 1. Awrejcewicz J.: Classical Mechanics. Kinematics and Statics. Springer, 2012.  2. Awrejcewicz J.: Classical Mechanics. Dynamics. Springer, 2012.  3. Awrejcewicz J.: Ordinary Differential Equations. Springer, 2014.  4. Awrejcewicz J., Koruba Z.: Classical Mechanics. Applied Mechanics and Mechatronics. Springer, 2012. |
| **Other reference materials** | Arnol'd V. I.: Mathematical methods of classical mechanics. Vol. 60. Springer Science & Business Media, 2013. |
| **Average student workload outside classroom** | 10 |
| **Comments** |  |
| **Last update** | 2019.04.08 |