



RTU Course "Dynamics of Flight"
15E03 Lidaparātu teorijas un konstrukcijas katedra

General data

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| Code | TAL442 |
| Course title | Dynamics of Flight |
| Course status in the programme | Compulsory/Courses of Limited Choice |
| Course level | Undergraduate Studies |
| Course type | Professional |
| Field of study | Transport |
| Responsible instructor | Pavelko Igors |
| Academic staff | Pavelko Vitālijs |
| Volume of the course: parts and credits points | 1 part, 3.0 Credit Points, 4.5 ECTS credits |
| Language of instruction | LV, EN, RU |
| Possibility of distance learning | Not planned |
| Abstract | Trajectories of aircraft. Axis systems. Equations of flight. Straight-line flight. Curvilinear flight in horizontal and vertical planes. Climb and descent. Range and endurance. Static longitudinal stability and control. Elevator angle versus equilibrium lift coefficient. Directional stability and control. Dihedral effect and lateral control. Longitudinal dynamics. Lateral dynamics. Flight at a high angle of attack. (JAR CPL Course, 08104-Stability, 08105-Control, 08108-Flight Mechanics) |
| Goals and objectives of the course in terms of competences and skills | To acquire theoretical knowledge of research methods of the dynamics of flight and its scope of use. Understand the basics of dynamics of the aircraft flight calculations. |
| Structure and tasks of independent studies | Term Paper Analysis of conditions of flight and longitudinal stability of the airliner, including: <ul style="list-style-type: none"> • calculation of necessary thrust, economic and cruise velocity, fuel consumption, duration and distance of the level flight (1 h.); • calculation of aircraft take-off and landing parameters (2 h.); • calculation of roll angle, vertical overload factor, velocity when turning in the horizontal plane (1 h.); • analysis of a longitudinal stability of the aircraft during short period perturbed motion (2 h.); • analysis of longitudinal stability of an aircraft during long period perturbed motion (4 h.); • preparation of a report (2 h.) Working with literature (12h) |
| Recommended literature | <ol style="list-style-type: none"> 1. JAR CPL Course: 08000- Principles of Flight, 08100- Subsonic Aerodynamics). 1998.- 250 pp. 2. Aerodynamics, Aeronautics, and Flight Mechanics, 2/e Barnes W. McCormick// John Wiley & Sons, Inc., 1995 ISBN 0-471-57506-2 672 pages 3. Л.Ф.Николаев. Аэродинамика и динамика полета транспортных самолетов// - Москва: Транспорт, 1990. -256 стр. 4. С. В. Богославский, А. Д. Дорофеев. Динамика полета летательных аппаратов - Санкт-Петербург: СПбГУАП, 2002 - 64 стр. 5. Lešinskis A. Aerodinamika. Mācību līdzeklis, Rīga, RTU, 2000.g. (elektr.v.) Lidojumu tehnisko raksturojumu aprēķins lidmašīnām. Rīga, 2000.g. (el.v.) |
| Course prerequisites | Aerodynamic forces and moments. Aerodynamic quality. Polar of a wing and of an aircraft. Adverse drag and inductive drag. Focus of a wing and of an aircraft. Thrust, fuel specific consumption, altitude-speed performance of gas turbine engine. Transient and stability. |

Course outline

| Theme | Hours |
|---|-------|
| Flight model scheme. Level flight, motion equations, duration, distance. Necessary and possible thrust. | 2 |
| Theoretical ultimate altitude of an aircraft. Calculation of duration and distance of flight level. | 2 |
| Motion equations, angle and time of climbing. Practical ultimate altitude of an airplane. Descending equations. | 2 |
| Maximum distance of gliding. Calculation of climbing angle and time. Calculation of the maximum distance of gliding. | 2 |
| Takeoff. Liftoff velocity and runup distance. Safe altitude climb distance. | 2 |
| Landing. Classic scheme of landing. Motion equations of the stages of landing. Rundown distance. | 2 |
| Calculation of liftoff velocity, runup distance, safe altitude climb distance, and rundown distance. | 2 |
| Aircraft maneuvers in the vertical and horizontal plane. Motion equations. Operational overload. | 2 |
| Calculation of parameters of flight and turning orientation. | 2 |
| The concept of aircraft balance. Main flight control devices of an aircraft. Trim tabs. | 1 |
| Forces and moments acting on an aircraft. Static forces and moments in longitudinal movement. | 1 |
| Longitudinal moment of wing, fuselage, engine nacelle, and powerplant. Longitudinal moment of an aircraft. | 2 |
| Calculation of the longitudinal aerodynamic moment of an aircraft. | 2 |
| Static lateral forces. Static moment. Static roll moment. | 2 |
| Damping longitudinal moment. Moment, which is connected with a downward deflection of airflow delay before empennage. | 2 |
| Forces and moments during rotation round longitudinal axis. Forces and moments during rotation round vertical axis. | 2 |
| Controlling aerodynamic forces and moments. Longitudinal static stability of an aircraft. Lateral static stability. | 3 |

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| Aircraft dynamic stability. Longitudinal perturbed motion equations. Linearization of center of gravity motion equations | 3 |
| Overload longitudinal stability. Stability of velocity. Short period and long period perturbed longitudinal motion. | 2 |
| Analysis of dynamic longitudinal stability of an aircraft. | 8 |
| Dynamic stability in the short period and long period perturbed lateral motion and its general characteristics. | 2 |

Learning outcomes and assessment

| Learning outcomes | Assessment methods |
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| Able to use aircraft motion equations to determine important maintenance characteristics at different conditions of flight. | Term Paper: Analysis of conditions of flight and longitudinal stability of an airliner. |
| Able to estimate static stability and controllability of an aircraft at specific conditions of flight. | Term Paper: Analysis of conditions of flight and longitudinal stability of an airliner. |
| Able to estimate dynamic stability of an aircraft at short period longitudinal motion. | Term Paper: Analysis of conditions of flight and longitudinal stability of an airliner. |
| Able to estimate dynamic stability of an aircraft at long period longitudinal motion. | Term Paper: Analysis of conditions of flight and longitudinal stability of an airliner. |
| Able to demonstrate theoretical knowledge of main regularities and research methods of the dynamics of flight. Able to solve typical tasks of the dynamics of flight. | Exam |

Study subject structure

| Part | CP | ECTS | Hours per Week | | | Tests | | |
|------|-----|------|----------------|-----------|------|-------|------|------|
| | | | Lectures | Practical | Lab. | Test | Exam | Work |
| 1. | 3.0 | 4.5 | 1.0 | 1.0 | 1.0 | | * | |