SYLLABUS

Eesti Lennuakadeemia
Estonian Aviation Academy

I. GENERAL DATA ON SUBJECT COURSE	
CODE AND TITLE OF SUBJECT COURSE (in Estonian and English)	**CNS.025 GNSS for Civil Aviation** *Sateliitnavigatsiooni süsteem tsiviillennunduses*
ACADEMIC YEAR, TERM, FORM OF STUDIES	2019 fall term, daytime e-learning
CURRICULUM, SPECIALITY AND MODULE WHERE THE SUBJECT BELONGS TO	Module of 2019 ER, e-course Students from all aviation specialities
VOLUME OF SUBJECT (ECTS)	3.0 ECTS
FORM OF CONTROL	Non-differentiated assessment
WORKLOAD AND FORMAT OF COURSE	Independent work 78 hrs
LANGUAGE OF INSTRUCTION	English
ADDITIONAL INFORMATION (prerequisites for enrolment for course, restrictions on participating in the course, etc)	Knowledge of English at upper-intermediate level (CEF B2).
LECTURER	Valeri Kravets, MEng

II. THE GOAL, LEARNING OUTCOMES AND ABSTRACT OF SUBJECT COURSE	
GOAL OF SUBJECT COURSE	This course gives the fundamentals of understanding the GNSS and its specifics for meeting the CA demands for its usage in aviation. Clarifies the GNSS augmentation systems like SBAS (WAAS, EGNOS) and GBAS, and the way they provide integrity monitoring. Gives an overview of contemporary RNAV architecture, approaches and CA requirements related to GNSS based navigation.
LEARNING OUTCOMES	The student having passed the course: 1. Can understand the foundation of GNSS for civil aviation applications accompanied by civil aviation requirement. 2. Has the knowledge of the architecture of the GNSS basic constellation and its operational principles and usage. 3. Has the knowledge of signal processing methods in GNSS.

	4. Has the knowledge of GNSS augmentation systems in aviation, like SBAS (WAAS, EGNOS) and GBAS. 5. Has the knowledge of contemporary GNSS based RNAV system, procedures and approaches and near future trends.
ABSTRACT OF SUBJECT COURSE	GPS, GLONASS, Galileo, BeiDou. Segments. Signals and modulation. GNSS receiver. GNSS accuracy and errors. Augmentation systems. RNAV. PBN. RNP.

III. GRADING SYSTEM AND CRITERIA	
PREREQUISITES TO BE ALLOWED TO TAKE EXAMINATION /PRELIMINARY EXAMINATION	During the term each student will have to follow the study principles given below in the next box.
FORMATION OF EXAMINATION /PRELIMINARY EXAM MARK	Course architecture and studying principles. The course consists of sectioned topics (chapters) which should be studied step by step. Time for a single topic (chapter) is not strictly limited but is about one week. At the bottom of the topics (chapter) windows there is a test to be taken after the learning process has completed. There is a one big task on the SBAS augmentation systems chapter, student must decode the part of the EGNOS message. At the end of the course there is going to be a final test covering the whole course with multiple choice questions to answer. The final score is an average of test results (50% is an average of chapter tests and 50% is the final test).
OPPORTUNITIES FOR SETTLING ARREARS	Students with specific problems can have extra assistance as required.

IV. TIMETABLE AND LIST OF TOPICS		
WEEK OF YEAR	**WORK FORMAT**	**TOPICS**
Week 40	Lecture 2h	**Introduction and warming up for course. Prologue.**
Week 41	Independent work 11h	**GNSS Introduction.** Basic concept of GNSS, role in civil aviation. History.
Week 42-43	Independent work 11h	**GNSS segments.** Segments of different GNSS systems – GPS, GLONASS, Galileo, BeiDou. Basic structure of GNSS receiver.
Week 44	Independent work 11h	**GNSS signals from space.** Spread spectrum, modulation, BOC. Legacy and new signals. Navigation data.
Week 45-46	Independent work 11h	**Receiving GNSS signals and navigation processing.** Receiver overall architecture. Signal acquisition and tracking. Navigation processing.

Week 47	Independent work 10h	**GNSS accuracy and errors.** Error components, horisontal and vertical accuracy. Integrity, continuity.
Week 48-49	Independent work 10h	**GNSS augmentation systems.** Satellite Augmentation System, there typical architecture and implementation. Space based Augmentation System. Ground based Augmentation System. Task - SBAS message decoding.
Week 50	Independent work 10h	**GNSS navigation and RNAV.** Area Navigation. Required navigation performance. Performance Based Navigation. RNP Approach.
Week 51	Test 2h	**Final Test.**

V. STUDY MATERIALS

1. **Moodle course: https://moodle.eava.ee/enrol/index.php?id=47**
2. Applied Satellite Navigation, R.Prasad, M. Ruggieri, Artech House 2005
3. GPS & WAAS, Max Trescott, Glass Cockpit Publishing 2009
4. GNSS applications and methods, Gleason, Scott, Artech House 2009
5. A-GPS: Assisted GPS, GNSS &SBAS, Frank vad Diggelen, Artech House 2009
6. Lots of www links on learning site and supplementary e-learning materials